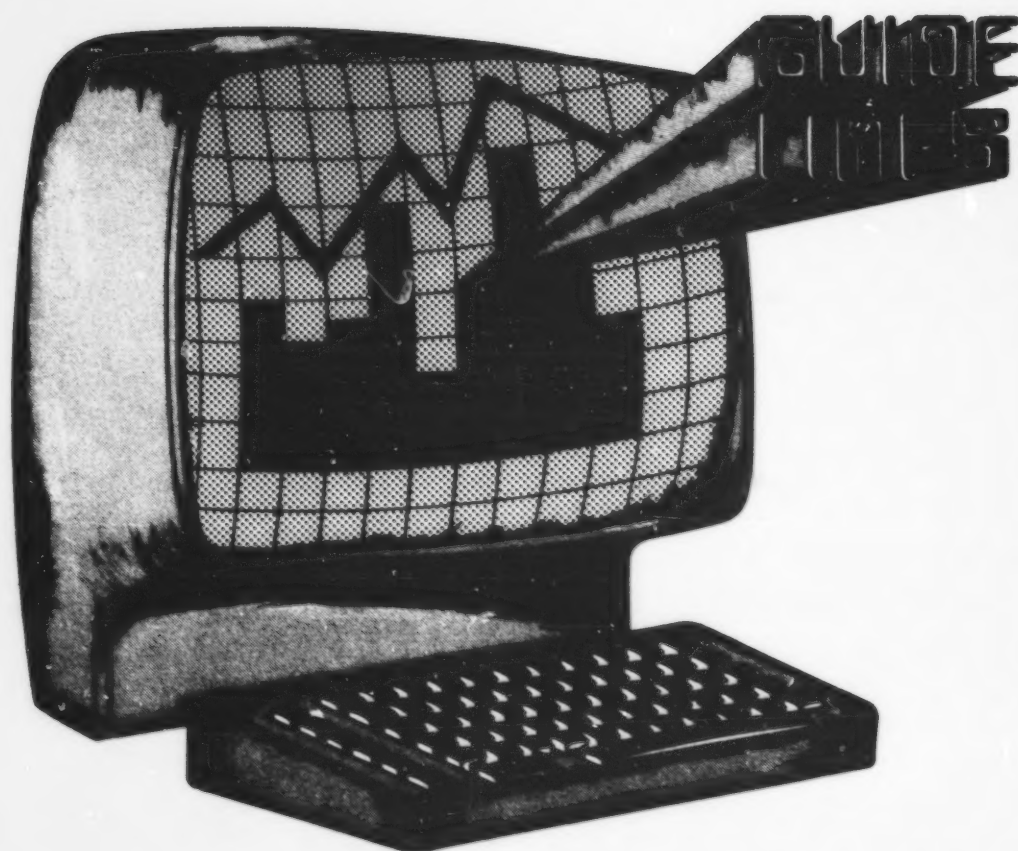




Saskatchewan
Urban Affairs

Saskatchewan

Computerization in Municipalities



Saskatchewan
Urban Affairs

COMPUTERIZATION IN
MUNICIPALITIES:

GUIDELINES





Minister
of Urban
Affairs

MESSAGE FROM THE MINISTER

It is my pleasure to present to Saskatchewan Municipalities, "Guidelines: Computerization in Municipalities."

This publication has been prepared to respond to the growing municipal interest in the field of computerization. Municipalities wishing to enhance the productivity of their administrative systems are increasingly facing the decision of whether or not to computerize.

This often complex decision can become even more bewildering when a municipality is exposed to the wide variety of products and services that are in the market today. While "Guidelines" cannot make the decision for a municipality, nor does it suggest one product or service over another, it is hoped the publication will help municipalities to make informed and rational computerization decisions.

My colleague, the Honourable Louis Domotor, and I hope that the assistance provided in this publication will prove to be both timely and helpful.

T.B.
Tim B. Embury



**COMPUTERIZATION IN MUNICIPALITIES:
GUIDELINES**

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GOALS AND SCOPE

In accordance with the announcement by the Honourable Tim Embury, Minister of Urban Affairs in June, 1984 at the Urban Municipal Administrators Association Convention, this publication is the first of two publications about the use of computers in municipalities.

The Minister outlined that this project would be developed by a technical steering Committee consisting of representation from Saskatchewan Urban Municipalities Association, Urban Municipal Administrators' Association of Saskatchewan, Department of Urban Affairs, and with the assistance of an external systems consultant. Representation on the technical steering Committee was subsequently expanded to include Saskatchewan Rural Development and the Rural Municipal Administrators' Association of Saskatchewan.

The objectives of this project were defined to:

1. Provide a guide to assist a municipality in determining its automation potential and its requirements,
2. Outline the conceptual requirements for common municipal applications,
3. Detail those requirements established by provincial legislation and regulation that must be considered by a municipality in developing its requirements for automation, and
4. Provide an outline of general issues that must be considered in any computerization effort.

In view of the time frame and complexity, this project was staged in two parts. The first part, Guidelines, describes the issues and concerns associated with the use of computers by municipalities.

The second part, Applications, will be designed to provide more detailed information as to what would be required within common municipal applications.

The requirements and procedures established by provincial legislation and regulation will be specified by application area. These application areas will include topics such as:

- Assessment and Tax Roll
- Water and Sewer Billing
- Budget/Cash Flow Analysis
- Financial Reporting (G/L)
- Payroll
- Cheque Issuance (A/P)
- Land Use Records

Publications will be updated to stay current with developments in computers and their use in municipalities in Saskatchewan.

The emphasis in this publication and the subsequent one, Applications, is to provide information that municipal decision-makers can put to practical use. Comments or inquiries should be forwarded to:

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1.0 COMPUTERIZATION: AN INTRODUCTION

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1.1 WHAT IS A COMPUTER?

A computer, in a word, is a tool. It is a machine that aids our memories by storing information (numbers, words, and facts) in its own memory. It carries out tasks we want it to perform by moving information in and out of its memory and processing it in some way.

A computer's chief characteristics are these:

- . it will do only what it is told to do,
- . it uses programs - sets of instructions written in computer language to make the computer carry out the tasks we want it to perform,
- . it carries out computations by means of arithmetic instructions (adding, subtracting, etc.) and logical instructions (shifting, comparing and testing the value of numbers and letters),
- . it can change the order in which it carries out instructions,
- . it sends messages to and receives messages from input/output devices, i.e., equipment attached to it which enables you to communicate with the computer,
- . it carries out the same instructions over and over again, without error or complaint, and at high speed.

1.2 THE MAIN TYPES OF COMPUTERS AND THEIR USES

There is some overlap, but the main classes of general-purpose computers are mainframes, minicomputers and microcomputers.

Mainframes

Mainframes are computers with very large memories and sophisticated processing units that are used, for example, by banks and airlines, as well as by government departments. Mainframes are used for jobs that require very large amounts of information to be stored and retrieved (e.g., the assessment file for a large city), and for jobs that require a lot of information to be entered and manipulated in some way (e.g., the financial reports for a large school board). Mainframes can be used simultaneously by many different users. They invariably require specialists to run them and cost \$250,000 or more.

Minicomputers

Minicomputers are physically smaller than mainframes and have less memory and processing power. Minicomputers may cost anywhere from \$20,000 to more than \$500,000 and may require at least one full-time specialist (for the larger minicomputers) to install and run them. Some municipalities in the 5,000-25,000 population range have installed a minicomputer to handle all their accounting requirements, using programs designed for municipal government purposes. Generally speaking, the purchase price of the software (\$20,000 to \$50,000 or more) includes the cost of getting the programs installed and working on the computer. The existing accounting staff are trained to operate the system; specialist data processing staff are usually not employed.

Microcomputers

Microcomputers which are the smallest computers, can be divided into two categories:

- . home microcomputers - intended for "non-business" purposes, that can be used for playing games and little else, costing under \$1,000 for the hardware and basic software.
- . office microcomputers (sometimes called small business computers) - designed with the capacity to handle functional activities such as tax billing as well as acting as personal productivity tools when used for such purposes as word processing. Their cost is in the range of \$1,000-\$20,000.

The computer concepts, parts and processes described in the remainder of this section are common to all computers.

1.3 SOFTWARE

It would be foolish to fall in love at first sight with a computer. The computer or "hardware" with all of its technical sophistication can be very appealing. Yet a long term relationship can only be built on a foundation of functional value; and this value can only be realized with proper "software". If a computer were a car, the software would be the driver.

Many of the things a computer does that seem so clever are only possible because the computer manufacturer has built in some very complex programs, the operating software. These programs control the execution of other programs, as well as the internal functioning of the computer.

There are four main types of software:

- . operating systems,
- . assemblers, compilers, and interpreters,
- . utility programs,
- . applications software.

1. **Operating Systems.** The most widely used operating systems, like much else in the computer world, are known by their initials - CP/M (Control Program for Microprocessors), and DOS (Disk Operating System) which comes in various versions for use with different makes of microprocessors. CP/M-80 has become virtually the standard operating system for 8-bit microprocessors and DOS in its various forms (MS-DOS, PC-DOS) the standard for the 16-bit microprocessors. The UNIX operating system and its derivatives (e.g. XENIX) seems to be becoming the standard for 32-bit microprocessors.

An operating system is a hard-working housekeeper. Here are some of the things it does:

- . manages the computer's hardware resources (e.g., when the printer prints or when the disk reads)
- . controls how the hardware works, (e.g., how to access information on disk)

- monitors the status and performance of both the hardware and the user's application programs,
- controls the allocation of space, saves, retrieves and keeps track of the files, and oversees disk and main memory storage.

It is necessary to know what operating system a computer uses. The programs that you want to use to carry out tasks (called applications software or application programs) must be compatible with the unit's operating system. There is a simple reason why they must fit. The application programs make use of operating system commands. If the application program uses one operating system's commands, and your computer has a different operating system, the application program will be unable to run on your system. It should be noted that different manufacturers sometimes utilize different operating systems.

2. Assemblers - Compilers. If we speak English and the machine understands only numbers, how are we to communicate? Programmers get around the problem by writing application programs in a computer programming language, which is somewhat like English. This language then has to be converted into machine language so that the computer can understand the program's instructions.

The software that does the translation is called an assembler, compiler or interpreter. One of these "translation" programs will be necessary depending on the language used for the application programs. COBOL and FORTRAN are languages that use a compiler; different versions of BASIC may use either an interpreter or a compiler.

3. Utility Programs. Utility programs are programs that assist in the computer's data processing operations. They instruct the computer to carry out routine chores, such as sorting data or recovering from errors or communicating to other computers. Some utility programs are supplied by the equipment manufacturer. Others can be purchased separately from suppliers.

4. **Applications Software.** With its operating software activated, the computer is ready and able to do something, but you have to tell it what you want it to do. This is where applications software comes in. Applications software refers to computer programs that instruct the computer to carry out specific tasks, e.g., print water bills, or post the general ledger. They are produced by independent suppliers as well as by computer manufacturers. Programs may also be custom written to meet the specific needs of a particular user.

Applications software is written in one of several computer languages, the most common being BASIC, PASCAL, COBOL, RPG and FORTRAN. These languages are called high-level languages because a single instruction written in one of them is translated by the computer into several instructions in machine language, which the computer then follows.

1.4 HARDWARE

THE CENTRAL PROCESSING UNIT (CPU)

The CPU, or microprocessor, is the most vital piece of hardware in a computer. It carries out, or executes, instructions which enable the computer to do the variety of tasks that users require. The CPU collects signals from other parts of the computer system, acts on them according to arithmetic and logical instructions, and send signals back.

MEMORY AND MEMORY-RELATED DEVICES

The memory is the computer's storehouse for information. Its size, or capacity (how much it can hold), has a very important bearing on what a computer can be used for - and therefore its usefulness. Memory devices are now most commonly produced as chips or in some magnetic form. The technology of computer memory is progressing rapidly and improvements are constantly being made.

A computer generally has three kinds of memory: permanent memory, called Read Only Memory, or ROM; temporary memory, called Random Access Memory, or RAM; and mass storage memory. Being produced in the form of chips, ROM and RAM can hold only limited amounts of information. This problem is overcome by using magnetic disks or tapes for mass storage of programs and data.

How Memory Size is Measured

The size of a computer's memory - RAM, ROM or mass storage - is measured in bytes. A K byte is roughly equal to 1,000 bytes and an M byte is roughly one million bytes. Since one byte is needed to represent a character, 1 K byte of memory will hold only about 1,000 characters. 64 KB of memory will hold 65,536 characters. This may seem a lot, but an average

page of text, for example, could easily contain 3,000 characters. Thus 64 KB of memory would store only about 22 pages of text.

ROM

Read Only Memory is used by the CPU. The switches on a ROM chip are permanently etched by the computer manufacturer. Thus the CPU can read the data or instructions in ROM, but it cannot alter them. ROM stores the start-up and control routines that the CPU uses constantly. ROM is permanent in another sense too; whether the computer is turned on or off, the contents of ROM do not disappear.

RAM

Random Access Memory, often called the main memory, is the memory you will be concerned with when you are considering the size of memory your computer will need, to do the work you want it to do. RAM allows instructions or data to be put into it, taken out, or simply read. The programs or data stored on disks, diskettes or magnetic tape are loaded into RAM. The CPU goes to RAM to get the instructions or data on which to operate. It can go directly to any location in RAM, which is why it is called random access memory. When the computer is finished the operation, it sends the data back to RAM. RAM can store any types of data or instructions, and is therefore very flexible. Being chip-based, it is also very fast.

The contents of most types of RAM are "volatile"; when the computer is turned off they disappear. Program instructions and data can always be put back into RAM the next time you use the computer because they are stored on disks, diskettes or magnetic tape. However, the results of any processing the computer has done will be lost, unless they have been transferred out of RAM, to magnetic tape or disks, before the computer is turned off.

When the computer is in use, RAM has to hold operating instructions, program instructions, and data. If the computer is to operate efficiently, its RAM must be large enough to hold a complete program and the data to be processed by that program.

Office computers need at least 64 k bytes of RAM. Many popular word processing packages require more than 64 KB, and some spreadsheet packages require at least 192 KB.

Mass Storage Memory

The space available for storing data or instructions in RAM is limited. This problem is overcome by using mass storage devices that are physically separate from the computer. This kind of memory comes in the form of disks, diskettes and magnetic tape. All three are used for storing large amounts of data, as well as programs.

Disk technology was developed to overcome the chief drawback of magnetic tape: the fact that it takes a long time for the computer to find the data it wants on a magnetic tape. (Access is sequential, not random, so the computer has to search the tape until it reaches the information it requires, instead of being able to go to that information directly.) Magnetic tape is still widely used for backup purposes, since it is much cheaper than disks. Disks use a magnetic medium but take a physical form much like that of a phonograph record, enabling information to be accessed randomly and quickly.

Disk Drive

A piece of equipment called the disk drive loads the program and data recorded on the disk into RAM. The disk drive has a read-write head mounted on an arm which can be positioned anywhere above the disk, like a stylus on a record player. The head reads and writes on concentric tracks. The density of tracks (the number of tracks per inch) determines how much data a disk can hold. The density may be single,

double or quad. Disks may also be single - or double-sided. The latter requires a disk drive with read-write heads that work on both the top and the bottom surface of the disk.

A motor in the disk drive rotates the disk, and another motor moves the read-write head into position. A program in RAM then accesses the disk and loads the data or instructions into RAM from the disk's memory. In this way, the microprocessor has very fast access to what it needs.

"Floppies"

Floppy disks, or diskettes, look much like 45-rpm phonograph records. They are now commonly available in two sizes: 8" ('floppies') and 5 1/4" ('mini-floppies'). They are not rigid but are housed in a stiff plastic envelope to protect them. A 5 1/4" floppy diskette can typically store from 120 to 400,000 bytes. An 8" floppy may store up to 1 million bytes, or 1 megabyte (1 MB). A new group of 'micro-floppies', between 3" and 3.5", is coming on the market. They have storage capacities as great or greater than those of the 5 1/4" mini-floppies, and are reported by the manufacturers to be much more reliable.

A floppy disk must be loaded into the computer's disk drive unit when you want to use the data or programs stored on it. When you have finished using the floppy you take it out of the disk drive.

Hard Disks

Made of aluminum with an iron oxide magnetic surface, hard disks (often called Winchester disks) are, as their name suggests, rigid. They are becoming more widely used in computers. A hard disk, unlike a floppy, cannot usually be removed from the computer, although removable hard disks are now becoming available.

A hard disk stores far more than a floppy disk of the same size - typically between 5 and 20 million bytes (5-20 MB). It is much faster at transferring data to the RAM. It is also much more expensive than a floppy disk.

INPUT/OUTPUT DEVICES

The equipment enabling us to communicate with computers and vice versa is, of course, more familiar than the computer's internal hardware. The input/output devices are what we see and use - the keyboard, the screen, and the printer. Disk drives, discussed above, are also input/output devices. Another device the modem, enables one computer to communicate with another via telephone lines.

The Keyboard

The computer's keyboard resembles the keyboard of a typewriter, but it has additional, special-purpose keys. The keyboard may be a separate unit, or it may be built into the housing of the computer.

The CRT

The cathode ray tube (CRT) is the part of the computer that looks like your television set. The CRT is also called a VDT (video display terminal) or a monitor. Like the keyboard, it may be a separate unit, or it may be built as part of a unit which contains the keyboard and the microprocessor. Its screen displays data or instructions that you are entering, layouts for the data, the output resulting from the computer's efforts, or messages such as error messages and prompts to help you do the right thing. Display screens are usually 80 characters wide and 24 rows long. With the right kind of software, it can display charts in graphic form, and engineering drawings.

Printers

The two basic types of printer are the impact, or "letter-quality" printer and the dot-matrix printer. A letter-quality printer prints a character - a whole letter, number or symbol - as a fully formed impression in a single stroke, exactly as a character is printed by a typewriter. But instead of a letter hammer or type ball that typewriters use, the printer uses a print wheel (often called a daisy wheel) or a thimble.

Letter-quality printers are slow, printing about 30 to 55 characters per second (cps). They are also expensive to buy and to operate. However, their printing looks better than that produced by a dot matrix printer.

The dot matrix printer deposits a pattern of dots on the paper, in the shape of a character. These printers are three to eight times faster than letter-quality printers and are less expensive to buy and to operate. The quality of their output can be improved to resemble letter-quality printing, but the means of doing so slows down the printer's speed. They do a better job than letter-quality printers of producing graphics, and they tend to require less servicing.

COMMUNICATIONS

One of the real strengths of a computer is that it can be linked to other computers, or to other office equipment. Linking one computer to another enables them to communicate. They can pass messages (electronic mail) and information (from other computers' data bases) and can share processing tasks (distributed networks). Whether you decide to link your computer to another computer depends on how you want to use the system.

Modems

One way of linking computers is by means of modem (modulator/demodulator). A modem is a device that allows data to be sent via telephone lines to another computer. It

converts the computer's digital signals to analog signals that the telephone lines use, so that the telephone can transmit messages to the receiving computer's modem.

2.0 THE COMPUTER QUESTION: WHETHER TO AUTOMATE

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2.1 PACKAGES: WHAT ARE THEY?

A package refers to an application program that is sold as a complete, self-contained unit, comprising a thoroughly tested program or series of programs ready for use as well as a comprehensive manual explaining how to use the package. A program sold as a package should be usable by the purchaser without any modifications.

Program packages, (also called software packages or application packages) can be divided into two major types: generic packages, and functional packages.

Generic packages are packaged programs that can be used by anyone in any organization - regardless of industry, or size of organization, or the experience of the computer user. Also, the tasks that generic programs perform are not restricted to any particular part of an organization. For example, the production of documents (letters, memos, reports, etc.) occurs right across an organization. So a generic package such as a word processing package could be useful to anyone who has to produce letters or reports. These packages enable individuals to improve their own productivity in carrying out their own work. A computer used primarily to run generic packages is thus being used as a productivity tool.

In contrast with generic packages, a functional package refers to a series of computer programs that perform the tasks connected with a particular organization function - for example, accounting, or tax billing or payroll. A computer used primarily to run such functional packages is being used as a "central" computer, in the same way that larger municipalities use mainframes and minicomputers as central computers.

These functional packages also differ from generic packages in another important respect. They are usually designed for a particular industry. Accounting practices among different industries or sectors of the economy vary quite a lot. An accounting package designed for commercial business therefore probably won't meet the requirements of local government without being heavily modified.

2.2 COMPUTERS AS A PRODUCTIVITY AID

Spreadsheet Packages

An electronic spreadsheet package turns the computer's screen into the equivalent of a very large sheet of paper with columns and rows, like the spreadsheets used for accounting or bookkeeping. These packages make it easier to produce a budget, for example, than using traditional manual methods. You tell the computer what numbers to work with, what calculations to perform, and when to perform them. If you want to change one of the numbers to see how it will affect the rest of the budget, the computer automatically changes all the related numbers.

Word Processing Packages

Word processing packages turn the computer into a typewriter that processes words electronically. These packages not only enable the computer to produce your letters, reports, minutes and so on, but they also allow you to rearrange paragraphs, change the wording, and re-format the appearance of the text, all automatically. Some word processing packages can compile lists, create indexes and check spelling.

Data Base Utilities, Report Generators, File Managers and Inquiry Packages

These packages enable you to set up computer files, search the file contents quickly, display information, update or correct it, rearrange it in a different order, and print it in report form. You have immediate access to all the stored information.

Graphics

Graphics programs convert numbers into pictorial form - pie charts, bar graphs, and so on. The "pictures" are often much easier to grasp than a table of numbers. They may be displayed on the CRT or printed out, or both. Graphics programs require a specially equipped dot matrix printer or a plotter.

Communications

Communications packages enable computers to communicate with each other over telephone lines via a modem. The linking of one computer to another makes it possible to send and receive information.

Integrated Packages

Packages are also available that combine some of the functions described above. An "integrated" package might combine a spreadsheet, a graphics program, and a data base utility.

2.3 MUNICIPAL USES OF COMPUTERS

Many municipalities find that word processing, spreadsheets and data base packages are the most useful generic packages. In addition to increasing individual productivity, they can be used to increase the efficiency of managing most administrative activities. A file management package, for example, enables you to retrieve information and draw up lists or indexes for bylaws, licence renewals, and allotment of cemetery plots.

Municipalities may be interested in acquiring a computer to carry out their accounting and tax billing functions. Since most computers are capable of handling these and other central functions, the equipment is not an issue. The real issue is whether packages exist that meet the specific needs of a municipality. If a municipality intends to implement a functional package, it requires one that is designed to meet municipal needs. For example, a tax bill shows the roll number, mill rate, assessed value, school support, and number of installments and their dates. These items are not handled by most commercial billing and receivable packages. To be useful, functional packages - unlike generic packages - must be specifically designed for municipal government.

Some of the municipal tasks that a computer can carry out are listed in Exhibit 1, together with the type of software - functional or generic - that is needed. The list is by no means exhaustive. Most people find that once a computer system is up and running, new uses emerge that were not apparent in their pre-computer days.

EXHIBIT 1

MUNICIPAL APPLICATIONS

MUNICIPAL TASK	SOFTWARE TYPE			
	FUNCTIONAL (FCN)	WP*	SS*	DB*
ACCOUNTING AND FINANCE				
1. Tax billing and Receivables	FCN			
2. Sewer and Water Billing & Receivables	FCN			
3. General Ledger and Financial Reporting	FCN			
4. Accounts Payable	FCN			
5. Expense Reports	FCN		SS	
6. Fixed Assets	FCN	WP	SS	DB
7. Capital Projects	FCN	WP	SS	DB
8. Project Estimating			SS	
9. Budget Preparation and Revenue Forecasting	FCN		SS	
10. Assessment Roll			SS	
11. Purchase Orders	FCN	WP		
12. Cash Payments and Receipts	FCN		SS	
13. Payroll	FCN			
14. Personnel Records	FCN	WP		
ADMINISTRATIVE SERVICES				
1. Letters, Memos, Reports		WP		
2. Bylaws, Contracts, Minutes Procedure Manuals		WP		
3. Mailing Labels	FCN	WP		DB
4. File Indexes		WP		DB
5. Lists-Employees, Vendors, Registration Records		WP		DB
6. Cemetery Plots, Capital Projects, Etc.		WP		DB
6. Registrations-License Renewals, Building Inspections, Etc.		WP		DB
PUBLIC WORKS AND OTHER				
1. Capital Equipment Inventory	FCN	WP	SS	DB
2. Maintenance Management	FCN	WP	SS	DB
3. Communications to External Computers or Computer Vendors				
Communications Package				

*WP = Word Processing; SS = Spreadsheet; DB = Data Base

2.4 COMPUTERS - A MANAGEMENT TOOL

The benefits gained from using a computer to run generic software differ somewhat from the benefits gained from running functional software. By using the computer for such tasks as word processing or financial planning, you are likely to achieve:

- improved productivity on the part of individuals using the computer. (This does not normally mean that staff or managers are displaced when they use a computer - merely that they can do more work in a given period of time. Overtime may be reduced.)
- higher-quality results (evident from a higher degree of accuracy, more detail or a more professional appearance).
- improved information for decision-making (evident from more sophisticated analysis of information or from more rapidly and more easily produced reports).

Using a computer to do some or all of your municipality's accounting can bring these benefits:

- improved cash flow through faster billing procedures and timely, up-to-date information on arrears.
- tighter control of expenditures through up-to-date, readily accessible financial information and improved controls over disbursements.
- improved office productivity because tasks previously performed manually are automated and because methods become more standardized. Less overtime and a reduced need for part-time staff may result.
- faster and easier responses to queries from the public, council, staff, and provincial and federal government authorities. (The computer, rather than the staff, does the necessary searching through files and compiling of information.)*
- overall, improved management since the computer can readily produce information for planning, control, decision-making and other management purposes.*

- . reduced dependence on particular individuals (staff turnover will not cause the system to collapse).
- . possibly, reduced audit costs - or at least they may not go up by much. A well-designed financial system can improve the productivity of auditors.

(*These two benefits may also be gained from generic packages, depending on how you use them.)

2.5 PLANNING FOR COMPUTERIZATION

As a municipal decision-maker, only you can decide, given your municipality's particular circumstances, whether a computer is practical. It is necessary to decide what functions or tasks you want the computer to do for your municipality and when: now, a year from now, or three to five years from now.

In order to arrive at realistic decisions, each application (the set of tasks that you want to put on the computer) must be considered from three points of view: operational, technical and economic. The purpose of this preliminary planning stage is to decide whether a computer is a practical solution. After the decision has been made about what to computerize and when it will be done, a detailed definition of each application is needed. This stage is called the requirements definition. Finally, you are ready to talk to experienced systems vendors.

2.6 THE COMPUTER QUESTION

If you have been thinking about acquiring a computer for your municipality, you already have a general idea of what you want to use it for. To narrow the possibilities, it is worth asking some questions about the practices and procedures now being used in your office:

- . What are the strengths and weaknesses of your present procedures?
- . Which procedures have the highest volume and process the same type of information repeatedly (e.g., tax revenue information which is used in billing, receivables and the general ledger)?
- . Which procedures most need improving?
- . Which activities are the most important to the administration of your municipality?
- . Which activities generate revenues? Which activities generate costs?
- . Are there activities which could be improved by greater timeliness, and accuracy, or could clerical resources be reduced?
- . Can current operations be streamlined to improve efficiency?

Beyond the work that you are doing now, are there functions that you should carry out (or services you should provide) that are possible only if you buy a computer - for example, producing reports that cannot be produced now because there isn't time to do so? How important are these functions and services? Has council asked for information that cannot presently be provided?

2.7 BENEFITS AND RISKS

Considering not only the benefits but also the risks at this early stage can save a lot of grief. For example, if you decide to computerize your tax billing and receivable system, your municipality stands to gain financial benefits from collecting taxes faster or at shorter intervals, thus improving cash flow. On the other hand, if the new system does not work properly, every taxpayer in your municipality may be affected, and you could wind up with serious problems.

You will naturally want your first efforts at in-house computerization to be successful. Failure may result in council vetoing any further attempts, or in you and your staff losing confidence in the project. Depending on your circumstances then, it may be wise to give priority to a fairly simple application - say, accounts payable - and to wait until you have gained experience with it before attempting any other accounting applications. Or you could start by learning how to use a generic package such as a word processing package, so that you can produce visible results quickly.

3.0 DETERMINING NEEDS AND DEFINING REQUIREMENTS

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3.1 GETTING ASSISTANCE

Some advertisements claim that you can buy, install and use a computer without any previous data processing experience. This claim may be true if the computer is used strictly for running generic packages, such as word processing or spreadsheets. However, with functional software, such as an integrated municipal accounting system, the issues are complex, detailed and unique to the individual municipality. (For example, what assessment information will you maintain in your tax billing system, and how will this information be updated?) A successfully automated accounting system will require:

- . experienced, objective advice in the planning, acquisition, and implementation stages; and,
- . an experienced vendor who can offer proven municipal software.

It is essential for the first-time user to have access to people who understand the use of computers in municipal government. There are several sources of assistance, including Saskatchewan Urban Affairs.

It is recommended that municipalities establish a computer advisory committee wherever appropriate. Ideally membership should consist of council members, officials from neighbouring municipalities that are using computers, data processing professionals, businessmen who use computers, or computer science educators. Even if such people cannot afford the time to sit on a committee they could still be valuable sources of information.

Another source of help could be a municipality, similar in size, that has already computerized the application you are considering. If no municipality has put the application you are considering on a computer, that may be a signal to the first-time user to reconsider the application.

It may be worth hiring a consultant if you cannot find any local source of experience. Anyone you hire as a consultant should be a professional who not only knows computers but who also understands their uses in municipalities.

3.2 ISSUES: OPERATIONAL AND TECHNICAL

Once the likely applications have been identified, they must be prioritized. What functions do you want to computerize now, in a year from now, and in three to five years from now? Your decisions about applications and their priority constitute your computer applications plan.

It is important to plan three to five years ahead. Otherwise, there is a strong possibility you will end up buying the wrong machine - one that is either too small and cannot be expanded to handle the extra workload, or one that cannot run the software packages you will need in the future.

1. OPERATIONAL ISSUES

An important question to consider is whether a computer could be successfully installed in your municipal office. This operational assessment can be performed by reviewing each of your planned applications.

The main purpose of an operational assessment is to find out whether the staff have the necessary experience and attitudes to choose and use computer systems successfully. For example, if you cannot identify a suitable staff member who can be trained as an operator, and who can type, you are facing an obstacle. These kinds of operational roadblocks should be discussed with council and staff.

2. TECHNICAL ISSUES

There are basically two ways of obtaining applications software: buying packages, or writing "custom" programs to meet your needs and your needs alone. You and your staff can write the custom programs or you can hire someone else to do it for you.

THE BEST ADVICE IS STRAIGHTFORWARD: LOOK FOR A PACKAGE. FIRST-TIME USERS SHOULD NOT GET INTO CUSTOM PROGRAMMING. IT IS EXPENSIVE, RISKY AND PROBABLY A WASTE OF TIME.

Besides being designed for municipal use and capable of being run on a computer, a functional package should be proven. Look for a package that has been successfully installed by at least two municipalities. If a package has not been successfully installed at least twice, it cannot be considered a proven package. Anything less may or may not work satisfactorily for you because it was designed to satisfy the particular needs of one user. Or it may be a prototype that is untested in a real situation. As pointed out earlier there are very few proven, functional packages available now, but more will come.

If you are a first-time user, it is strongly suggested that you do not recommend any application to council for which you cannot find a proven package.

Be aware that even proven packages will not be 100% perfect. Because local government use of computers is new, functional packages are not yet refined to the point of being completely satisfactory. This doesn't mean that you should not buy them. It does mean that you should proceed with care.

Cost - Proven functional packages for municipalities include tax billing, receivables, payables, general ledger and financial reporting. Based on 1984 pricing, experienced vendors are selling these packages without modification and with limited implementation/training for approximately \$2,000 to \$3,000 per application. So the four applications listed above would cost from \$8,000 to \$12,000.

In comparison, standard commercial accounting packages for small businesses may sell in a computer store for \$400 to \$1,000 each. Some of these packages are much cheaper because their potential market is huge - upwards of half a million purchasers. If you plan to run between two and five functional applications, a faster printer (say 180 characters per second) is needed, and so is more memory. Instead of two floppy disks, you may require one hard disk (10-20 megabytes) plus one floppy disk as backup (320-800 kilobytes). The equipment cost would be upwards of \$10,000.

Maintenance - The only kind of hardware maintenance available for most computers is remedial maintenance, i.e., when something goes wrong, you ask the vendor to fix it. (In contrast, preventive maintenance is available on a regularly scheduled basis for larger computers.)

For software, maintenance generally takes the form of providing assistance to the user when problems are encountered in running an application package. Some vendors provide this support by telephone. In some cases, it is possible to negotiate with the vendor to make modifications to the package as the need arises, for a charge.

Performance - Some computer vendors place great emphasis on the speed of the microprocessor as measured in millions of machine instructions per second. In determining performance, the most important factor is not the speed of the processor but the speed of the operator in entering data and correcting errors. Don't allow yourself to be distracted by hardware performance claims when selecting your system.

Compatibility - The computer industry is young. There are very few standards and those that do exist are loosely defined and often ignored. As a consequence, computer buyers have to be cautious about compatibility, (the ability of one part of a computer system to work with another). At this point, you need to be concerned about compatibility only if:

- . you are thinking of buying software that runs on a Brand X computer and running it instead on a Brand Y computer. Beware of claims that software is transferable. Ask for a demonstration.
- . the equipment you are thinking of buying is supplied by different vendors (e.g., the computer from vendor A, and the printer from vendor B).
- . you may need to receive data or programs from your computer via diskette or telephone lines from another computer.

Compatibility is a highly technical matter. If you find yourself in one of the three situations described above, it would be wise to get expert advice. Experienced buyers insist that the vendor demonstrate the equipment, programs and files working together.

Reliability - Encompasses:

- . the frequency with which the hardware or software programs fail,
- . how quickly the vendors' service personnel respond,
- . how quickly and effectively the service person repairs the failure.

Expandability - Some computer systems have more room for expansion than others. Your system must be able to grow for two reasons:

1. Application growth - as you add more applications you will consume more of your hardware's capacity (keying printing and processing time, plus disk capacity).
2. Volume growth - as your municipality grows (e.g., more taxpayers) or as you process more information through each of your applications (e.g., more pages of text in word processing) you will also require more capacity.

The addition of unplanned applications is one of the most common reasons for having to expand your system unexpectedly. A realistic applications plan that schedules what will be installed and when, will help determine the correct capacity.

3.3 DEFINING REQUIREMENTS

In this stage, it will be necessary to document your requirements in detail. You can find help in defining your requirements by:

- . talking to a municipality of similar to slightly larger size that has already computerized the application(s) that you are considering and therefore knows what is required,
- . asking a consultant with municipal experience for assistance.

DEFINE APPLICATION REQUIREMENTS

You can approach the definition of your requirements for applications in one of two ways:

- A. Spend some time looking at what existing packages can do, and then decide which package best suits you; i.e., your requirements are determined by what is available.
- B. Draw up a list of your requirements, ignoring for the moment what existing packages actually offer. Look at packages only after you have decided what you want.

Approach A is based on the assumption that, because you are looking at packages designed specifically for municipalities, they will in large part meet your needs. In other words, the requirements have already been defined by the packages' developer and users, so you don't have to spend time on this task.

This approach requires caution. Salesmen (and sales brochures) will naturally emphasize what their products can do, not what they can't do. It is therefore essential to seek some users' opinions if you choose this approach. (Even then, other municipalities' needs may not be identical to yours. So what suits them may not suit you.) Also, if you haven't independently defined your requirements first, it is easy to overlook apparently small differences that may prove to be very significant.

Approach B the recommended approach, will require more "upfront" effort on your part. However, if you first think through and write down precisely what you want the computer to do, you will be able to look at packages with an informed eye. If they do not match your needs precisely, you will be aware of their shortcomings and can find out about modifications, or you can decide which of your requirements you are willing to change or forego.

Visit Other Municipalities

You can gain very useful insights from visiting other municipalities that have installed integrated accounting systems on mini or microcomputers. Experienced users are generally glad to explain the strengths and weaknesses of their computer system and to show you some of their system documentation (reports, input documents, file layouts).

You can telephone or visit these municipalities to discuss their systems or see them in use. If you choose a system that several other municipalities are using, you may be able to share their municipal procedure manuals. It is illegal however to obtain copies of the actual programs and the program manuals published by the system producer from anyone other than the producer or licensed distributors.

Review Vendor Documentation

Sales literature is available from vendors for different software packages. In the case of generic packages, you may find it useful to read reviews in computer magazines. Some articles contain feature-by-feature comparisons of packages - a big help to prospective buyers. Your local or regional library should be able to track down such articles for you.

DEFINE HARDWARE REQUIREMENTS

Having defined and documented what you want the application software to do, the next step is to define your requirements for hardware. This will involve examining volume, capacity and types of equipment.

Determine Volumes

The volume survey is the key to determining hardware or equipment capacity, hardware cost, and the technology alternative (microcomputer, mini or service bureau).

For each application, it is necessary to estimate:

- . how many documents there are at peak times, (i.e., the maximum amount that the computer will have to handle), and
- . how long you want to keep detailed information in the computer.

Analyze Capacity

If a computer proves to be too small six months after it has been installed, the usual reason is that no attempt was made to figure out the required capacity before purchasing the equipment. Instead, the buyer relied on the equipment configuration recommended by the vendor.

By determining the capacity that the computer must have to meet your needs now and in the future, you won't have an unpleasant surprise a short time after buying your system. You need to know what capacity you require for all four main components of the system:

- . the disk, measured in millions of characters or bytes (MB) to be stored,
- . the printer, measured in hours of printing per month,
- . the keyboard, represented in hours of typing per month,
- . the processor, measured in hours of processing per month.

By knowing your volumes, you can calculate the system's capacity.

The design of both the application software and the vendor's equipment can affect capacity. It is wise to insist that any vendor proposing to sell you a system prepare a capacity analysis and present it to you, using the information you provide about your application workload requirements and processing volumes. For example, you may want to save your general ledger (G/L) detailed posting for twelve months. In this case, the G/L detail file will probably be your largest computer file. You will therefore need adequate capacity to accommodate it, and you will want to be sure that the vendor hasn't overlooked this requirement.

You can also contact municipalities the vendor has provided as references, as an informal method of verifying the capacity. They should be municipalities of about the same size that have computerized the same applications as you want to computerize.

Type of Computer System

Your first hardware decision will be based on the results of your capacity analysis. It will determine what type of computer system you will require. Some alternative systems are as follows:

- . A microcomputer which has only one terminal and one printer and is capable of running only one job at a time, i.e., a single-terminal microcomputer.
- . A multi-terminal microcomputer which is capable of supporting 1-3 terminals and up to two printers. This type of system would be suitable for small municipalities that have a sizable application workload (tax billing and receivables, water billing and receivables, a complete accounting system and terminals for word processing).
- . A minicomputer is preferable when a small municipality requires more than three terminals because of its application workload and volumes. This situation could arise if two municipalities (each with fewer than 5,000 residents) decided to share a computer.

Multi-terminal microcomputers do not perform as well as minicomputers at present. If you want a multi-terminal microcomputer, ask the references named by the vendor how well the system performs (response time at terminals and overall speed). The vendor should provide a guarantee of performance in any contract to buy a microcomputer system, whether multi- or single-terminal.

It is an advantage to have a widely used operating system for your computer because it may allow you a wider choice of application packages. Similarly, choosing an application package (functional or generic) written to run on a widely used operating system will allow you, in theory, to avoid or reduce conversion costs if you move your applications from one make of computer to another. In practice, the costs of converting functional packages may amount to more than the cost of buying a new package.

3.4 CONSIDER ALTERNATIVES

Before you reach the conclusion that a computer is the most practical and cost-effective solution for your functional applications, consider the alternatives:

- a) **DO NOTHING.** It is possible that your best choice is to live with your present situation. The situation could be reviewed in one or two years.
- b) **STREAMLINE YOUR CURRENT MANUAL METHODS.** In taking a look at your current system and procedures, you may have uncovered practices that could readily be simplified or eliminated. If so, taking these steps may be a sufficient solution.
- c) **ADD MORE STAFF.** This may be the fastest alternative to implement. It may also be expensive.
- d) **USE A SERVICE BUREAU, OR IF YOU ARE ALREADY USING ONE, TRANSFER ADDITIONAL FUNCTIONS TO THE SERVICE BUREAU.** The service bureau will work well for small municipalities interested in automating only one or two functional applications and not wanting to make extensive use of generic packages. By having your work processed on the service bureau's computer, you can computerize applications on better equipment than you could afford yourself. You may also be able to use their programs rather than spending time and money on programs of your own. Also, if something goes wrong, you don't have to fix it.
- e) **USE ANOTHER MUNICIPALITY'S FACILITIES.** There are many variations on this theme. For example, you may use another municipality's computer and buy a computer of your own to use as a terminal linked to the larger computer.

Using another municipality's equipment is much like using a service bureau. The main advantage is that it's in the same field as you are, and you may use most or all of its programs. The main disadvantage is that your computer needs may not receive priority.

- f) **IF YOUR PRIMARY REQUIREMENT IS WORD PROCESSING, BUY A COMPUTER FOR THIS PURPOSE.** If the word processing work would consume more than two to three hours a day, it may be cost-justifiable to buy a microcomputer solely for

running a word processing application. Another alternative is a dedicated word processor. However, the latter is more expensive than a microcomputer, and, unlike the microcomputer, it can seldom be satisfactorily used as a multi-purpose machine.

- g) **ACQUIRE A MINICOMPUTER AND SHARE IT WITH ANOTHER MUNICIPALITY.** If your application workload and volumes exceed the capacity and capability of a microcomputer, you could consider buying a mini instead. It might be possible to share one between two or more municipalities.

The comparative advantages of microcomputers, minis, and shared services are summarized in the Exhibit 2. You will, of course, need to examine the operational, technical, and economic aspects of the alternatives.

COMPARISON OF ALTERNATIVES

COMPARISON FACTOR	MICROCOMPUTER	MINICOMPUTER	SERVICE BUREAU
1. OPERATIONAL	- Minimal support from most vendors; requires committed user + User determines priorities within equipment limits	+ Support varies by vendor + User determines priorities	+ Requires least commitment; use can grow in stages - Scheduling conflicts on quarterly billing, month end; reports may be difficult to get when you want them
2. TECHNICAL	+ Packaged software varies in quality by vendor + Capacity limitations	+ Mature, proven software packages + Better growth capacity	+ Mature, proven software packages + Unlimited growth capacity
3. ECONOMIC	+ May be cheapest if technical and operational issues can be resolved, and user wants a total system and a fixed cost - Purchase only, or short-term financial lease (under 36 months) - High cash outlay for initial purchase	+ Cheapest solution for complete, integrated systems if volumes are large and require several terminals, large disk capacity (30-100MB) and you want fixed costs + Variety of financing plans - More expensive than micros; may be justified if growth capacity is required	+ Cheapest solution for single application or very small municipalities with 1-2 applications + Minimal initial cash outlay + Flexible commitment - Costs vary with volume and may rise due to inflation - Most expensive over 5-7 years if the municipality wants a complete accounting and management system (5-7 applications)

NOTE: + = an advantage
 - = a disadvantage
 ± = there could be disadvantages and advantages

4.0 PREPARING A REQUEST FOR PROPOSALS OR A TENDER DOCUMENT

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4.1 THE MARKETPLACE

When and how you go about "shopping" for your computer system depends on what you plan to use your computer for and what type of system you want.

If you are looking for a single-terminal system on which you intend to run one or more popular generic packages, you have a reasonably wide choice of vendors. If, however, you are intending to use the computer for functional applications, your choice is much more restricted, and the selection process has to be much more rigorous, since there is so much more at stake. There are also far fewer packages from which to choose.

In either case, there is an important fact about the computer marketplace that has several implications for the buyer:

**THE COMPARATIVELY LOW PRICE OF COMPUTERS HAS
LITTLE TO DO WITH TECHNOLOGY AND A LOT TO DO WITH
THE WAY IN WHICH COMPUTERS ARE SOLD AND SUPPORTED.**

Microcomputer vendors operate on narrow profit margins. Accordingly, some vendors are neither willing or able to spend a lot of time helping you to select a microcomputer. The buyer is expected to do the "walking and talking" necessary to understand the differences between products.

It is standard practice when buying larger computer systems to send out a formal document called a Request for Proposal (RFP) to vendors. This document sets out the software and hardware requirements in considerable detail and asks vendors to respond with a proposal to meet these requirements. Because microcomputer vendors have small profit margins, they are generally unwilling to prepare extensive proposals. Nevertheless, for your own protection, your requirements should be given to the vendor in writing, and the offer to supply you with products and services should be put in writing. Your documented requirements and the vendor's written response will avoid misunderstandings and will be a useful addendum to any purchase contract. A municipal microcomputer system must not simply be picked off the shelf.

The focus when selecting a computer should not be on identifying the vendor with the lowest price. Rather, you should concentrate on finding the vendor with the highest-quality application software and the best reputation for support. Good software and good support will cost more than basic software and no support. These benefits are generally worth the extra cost.

4.2 SELECTION PROCESS

The major steps in selecting a vendor (or vendors) are:

1. Identifying qualified vendors
2. Dealing with vendors
3. Evaluating vendor responses
4. Selecting the best vendor
5. Keeping council informed
6. Negotiations

The way in which you select a vendor will naturally have to conform with your municipality's purchasing practices. Within those constraints, however, there are two basic approaches to following the six steps listed above:

- the formal approach involves issuing a request for proposals (RFP) to vendors and using a selection procedure that has several stages,
- the informal approach does not involve an RFP and has fewer stages.

Each approach has advantages and disadvantages as highlighted below:

FORMAL vs. INFORMAL SELECTION APPROACH

Formal Approach

Informal Approach

(+ = Advantage; - = Disadvantage)

- | | |
|--|---|
| <ul style="list-style-type: none"> + simplifies evaluation for the buyer, + requires less buyer time during evaluation and selection, + provides a very comprehensive definition of the requirements, + reduces the chances of misunderstandings and subsequent disputes, - requires more buyer effort before contacting bidders, | <ul style="list-style-type: none"> - places greater responsibility on the buyer for evaluation, - requires buyer to spend more time on evaluation and selection, - may leave room for misunderstandings, + requires less time before contacting vendors, + requires vendor to spend less time on preparing a response. |
|--|---|

- requires the vendor to spend more time preparing a proposal.

The formal approach is preferable when:

- a) there are three or more qualified potential vendors; and/or
- b) you must tender all purchases in accordance with your bylaws and policies.

The informal approach is preferable when:

- a) there are only one or two qualified potential vendors, and
- b) you plan to use the computer primarily for word processing and perhaps some other generic packages.

4.3 THE REQUEST FOR A PROPOSAL

Vendors of Functional Packages and Hardware

Functional computer-based packages that are designed to meet municipal needs are sold by very few vendors at present. These vendors generally sell the software and also supply the hardware on which it runs.

Talk to other municipalities with successful computer installations, to whittle down the list and get the latest information on vendors.

Once you have identified experienced municipal computer vendors, phone each of them. The purposes of this initial contact are to establish:

- . what municipal software they currently offer (or whether they are interested in developing municipal software),
- . what their relevant experience is (they should be able to name municipal computer references),
- . whether they are able to support and maintain your installation during implementation and throughout the life of the system.

For your part, you should be able to communicate your needs clearly and thoroughly to the vendor. He or she should be convinced that your municipality is a serious prospect - that you are not merely window-shopping.

In some cases, you may feel obliged to contact a vendor who is established locally but who has no proven software or relevant references. There is nothing wrong with this, but remember that it is virtually impossible for an inexperienced vendor to match both the quality and the price of an experienced vendor's package. If the prices are comparable, the inexperienced vendor's software could have significant deficiencies.

Vendors of Generic Packages and Hardware

If you are planning to use your computer primarily for functional applications, with, say, a little light word processing, your choice of generic packages is restricted. Why? Because the functional applications will determine the operating system and thus your choice of computer. Consequently, the generic packages you buy must be capable of running on the same hardware and operating system. The task then is to identify a word processing (or other generic) package that meets this requirement. The vendor(s) of functional packages should be able to tell you which popular generic packages can be run on the same equipment.

If you intend to use your computer solely for running generic packages, you can shop around at computer retail stores for both generic software and the hardware.

Look for a retailer (preferably local) who can support the generic package you want, i.e., you can telephone the retailer if you have problems and be given advice. Some training programs or other training aids should also be available from the retailer. Although some generic packages can be obtained by mail order, you will have no one to turn to if you run into problems with packages purchased this way.

As for hardware, there are manufacturers' distributors and both chain and independent retail stores that you can visit. Department and other "non-specialist" stores such as office suppliers also sell equipment but, again, they may not offer the support you will need if you are new to computers.

4.4 TENDERING A SYSTEM

Vendors of Functional Packages and Hardware

It is vital to supply vendors of functional packages with a written statement of your requirements for both software and hardware.

It is common practice to allow vendors about three to four weeks to submit their responses from the date of sending or giving them your written requirements.

Vendors may be concerned about their package's ability to supply either essential or desirable features. It is important to remember that no vendor will meet 100% of your requirements. Therefore, vendors who can meet 70-80% of your requirements should receive further consideration. Encourage vendors who can achieve the intent of a particular requirement (through some other feature) to recommend alternative ways of satisfying the requirements. In other words, all reasonable ways of meeting a particular requirement should be considered.

It is also common practice to disqualify vendors who attempt to deal with non-designated officials in the municipality.

Vendors of Generic Packages and Hardware

If you are buying generic packages only, your best source, as stated earlier, is a computer retail store. The retailer is usually not the original writer of the software. They should nevertheless, be able to tell you in general terms whether the package does what you want it to do. But the onus is on you to establish this; they may, for example, allow you to examine the package's manual to compare the package with your list of requirements or allow you to operate the package on a trial basis.

With regard to hardware, the retailer should be asked to respond in writing to your documented hardware requirements, and should complete the pertinent cost tables. They should be able to advise you about brands of equipment they sell and about equipment capacity and performance.

5.0 EVALUATING A PROPOSAL AND SELECTING A SYSTEM

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5.0 EVALUATING A PROPOSAL AND SELECTING A SYSTEM

The purpose of evaluating responses is to make a thorough assessment of the vendor's responses and to do so as fairly and objectively as possible.

5.1 SOFTWARE

Ensure the software has the qualities and requirements to meet the program requirements for your municipality.

5.2 HARDWARE

Determine the most appropriate equipment for your municipality. It should have adequate capacity and service required to ensure user satisfaction.

5.3 LEASE OR PURCHASE

Essentially, the components of the system may be acquired by the user through any of the following methods or any combination of these approaches:

1. Purchase

Outright Purchase: Under this approach, the user acquires the system through its own internal source of funds. Undoubtedly, if the user chooses to borrow funds beyond the current year, approval of The Local Government Board is required.

Agreement to Purchase: In this type of transaction, payment for the equipment is made to the supplier over a predetermined and stated period of time. Title to the equipment will remain with the supplier until the final installment is received. If the period of time extends beyond the current year, approval of The Local Government Board is required.

2. The leasing environment

It is not unusual for the user to acquire a system under the terms of either a:

Rental or operating lease. This is essentially a short-term lease with the equipment supplier. It usually has a duration of about one or more years, with stipulated monthly payments and surrender of the equipment at the end of the term. Although the monthly cost to the user will be higher than that of a finance lease, it is of relatively shorter duration and affords the user the opportunity to "try before you buy". Some suppliers will offer a credit of a percentage of the accumulated rentals as an incentive to the user to purchase the equipment in lieu of renting it. If a lease is binding on future councils, it requires the approval of the Local Government Board.

Finance lease. A lease of this type will generally come about in one of three ways:

- . once the user has selected the configuration that best suits the needs and all appropriate documentation has been signed, the supplier will sell the equipment to a third party leasing company, which in turn leases the equipment out to the user, or
- . the equipment lease itself, originally entered into directly by the user and the supplier, is assigned by the supplier to a third party leasing company, or
- . the user, following purchase of the equipment from the supplier and satisfaction as to its operation, may sell the equipment to a third party leasing company, which in turn will lease the equipment back to the user for a fixed term.

Generally the term of the lease will vary from five to 15 years, depending upon the credit-worthiness of the user, the expected useful life of the system, and its residual value. The lease may afford the user an option to purchase at the end of the term. The monthly rental will be made up of the capital cost of equipment plus the finance charges on this capital cost, which is then amortized over the term of the lease.

In any of the above-described situations, the user may wish to consider the following issues:

- . How are any manufacturer-supplied warranties and representations to be preserved?
- . What rights, if any, does the user have to withhold rent in the event that the system does not live up to its expectations?
- . How are systems software and applications software licensing arrangements handled under either of these leasing arrangements?
- . What rights does the user, as lessee, obtain under the lease to ensure their rights will not be interfered with by any parties claiming through the leasing company?
- . What are the lessee's insurance obligations towards the lessor?

3. Insurance coverage

The user's existing and potential insurance coverage should be thoroughly reviewed. This will verify that the appropriate coverage is in place, with limits that are acceptable and deductions that are satisfactory to the user and lending institution (if it is a financed acquisition). It will also ensure that any additional endorsements (such as the cost of disaster recovery in

the case of destruction of the system and reconstruction of data) are provided. Do not be surprised if you need additional coverage; the area of insurance must be thoroughly canvassed.

5.4 SHARED OR OWNED

Taking into consideration all aspects of acquisition, it may be advantageous for two or more municipalities to share a system. This would depend upon economics, size, and need of smaller municipalities who could benefit from such an arrangement.

5.5 OWNED BY MUNICIPAL OFFICIAL

In some cases a municipal official may own a computer system and use it for municipal purposes. Municipalities should be aware of the consequences upon departure of the system's owner.

In the event of such an arrangement, municipalities are well advised to ensure that a contract and adequate backup facilities are in place.

5.6 FIRST-TIME BUYER PITFALLS

"I'll buy it first and then decide what to use it for".

If this book has a message, it is this: application first...equipment second. Reversing this order is a sure way to end up with an expensive executive toy.

"It only costs \$8,000; let's buy it".

Maybe the equipment only costs \$8,000, but if you lose your receivables in trying to computerize them, it could end up costing a whole lot more than that!

"They've got one, so we should get one".

Stop! First ask, will it solve a problem for you? Will it enhance productivity? Remember, fools rush in...

"Sure, I'll fix it for you if you have problems...but these things never break down".

Oh yeah?...then he won't mind giving you a written maintenance agreement. The original warranty is usually only good for 90 days. Thereafter, maintenance will probably cost you about seven to twelve per cent of the purchase price each year (including parts and labour), but it's worth it!

"The software's due anytime".

"Anytime" may be right! With the best of intentions and effort, developing and releasing commercial software and related documentation is often fraught with problems. Don't buy until you have the official software package (not a test version) in your hands and you've tested it on the equipment to your satisfaction. Many dealers and software suppliers will let you examine the software and manual for a trial period at little or no cost.

"We've got a lot of problems, but we're getting a computer".

This buyer is asking for trouble...there is a new "old adage: Don't computerize a mess...clean it up first". It is important to understand that a computer can't help you to do things you don't understand, and it won't make decisions for you. All it does is process a lot of information very quickly...exactly as it is told. To be of any real use, a computer requires a disciplined approach and an organized mind.

"We can afford a microcomputer; it's only \$10,000".

True, but what about the system software and the application packages? They may come to \$3,000. And the maintenance (\$1,000), and the sales tax, and the diskettes (\$6 or so each), and the paper (\$25 per 1,000 sheets), and the printer ribbons (\$10-20 each), and the diskette holders (\$50), and...? When you add it all up, the chances are that a computer won't reduce your staff costs. It may, however, help you to manage the municipality a lot better. Experience shows that the follow-up purchases in the next two years often exceed the original cost of the machine.

"Tell me what I should buy; you know better than I do".

Before you put your fate in the hands of a salesperson, remember that they are exactly that. They don't know your municipality or your particular needs. They may not even have much technical knowledge about the product. They are paid to sell equipment. So treat all gratuitous advice from salespeople as suspect. Be prepared to ask all the questions to which you need answers. And learn enough to be able to evaluate the information the salestaff gives you. If you need help, seek independent, experienced assistance. If you have a choice of dealers, don't go by the price, but by their technical competence and willingness to provide genuine help.

"Have I got a deal for you!"

Buying used computer hardware requires a level of expertise well beyond that of the average first-time buyer. So unless you have access to some very experienced and knowledgeable assistance, it is probably wisest to leave the "slightly used" bargain market alone. When you buy new equipment you know you are not buying someone else's

problems and you get the warranties and dealer support that are vital with a purchase of this magnitude. Another point is that, if you are looking at used equipment, the chances are you are basing your purchasing decision strictly on price.

"The manuals will tell you everything you need to know"

First make sure you get all the manuals you're entitled to. Such as:

- . **the operations manual** - this is vital...it tells you what devices you've got, how to connect them, how each of them works and how to operate and care for the whole system. Anyone who intends using the system should spend some time with this manual.
- . **the operating system manual** - this is much more technical and should not be necessary initially for the first-time user. It describes the various functions of the operating system but, if the application programs are well written, you shouldn't need to refer to it too much unless you're a programmer. However, make sure you've got it.
- . **programming manuals** - there should be one of these for each programming language on the system - BASIC, PASCAL, and so on. These are essential if anyone is going to write programs on the machine.
- . **application package manuals** - not only are these essential if you buy the packages, they are an essential part of deciding whether to buy them. Read at least the general instructions and scan the rest. Can you understand it? Try to run the application just by referring to the manual. A good package without a good manual is only half a system.

Epilogue: a word on implementation

Having put a considerable amount of personal time and effort into making your purchasing decision, you are probably anxious to see your new computer system up and running as quickly as possible. This is understandable, however be warned that underestimating the amount of management time and effort involved in system implementation is a common mistake made by first-time buyers. Loading all the starting data and learning all the

procedures in order to put a business application program into operation is a time-consuming task...be prepared to give it the effort it deserves.

5.7 VENDOR SELECTION AND EVALUATION

A vendor presentation should be arranged with the best vendor as well as at least one site visit to a suitable municipal installation. You, your selection team (if you have one) and the staff who will be using the computer should plan on spending one full day with each vendor: half a day at the vendor's offices and half a day at one of the vendor's municipal clients.

References

Use a software and hardware reference checklist to tailor a list of questions to ask the vendor's customer references. At the customer site(s) you should talk to both the administrator and any office staff who use the equipment to obtain their views on the strengths and weaknesses of both the software/hardware and the vendor(s). Invite them to share their experiences and to make suggestions to help you in your efforts.

Re-evaluate

After demonstrations by the vendors and other municipalities re-evaluate the vendors. Use the original selection criteria, supplemented by your insights gained from the demonstrations and from the answers obtained to your questions.

Keep your Council Informed

It is essential to keep council informed about the project from the inception of the study and throughout the process. You must let them know what you plan to do and how long it will take. The frequency and detail of the status reports will depend on what council wants.

You will likely want to prepare a final report to council of your computer recommendations. This report could be two to three pages in length and should cover the following topics:

- a) The process that was followed and the people involved
- b) The analysis of the proposals and evaluation findings
(include a copy of your final evaluation summary)
- c) The major findings resulting from vendor demonstrations,
site visits and reference checking
- d) A final recommendation
- e) Budgets, schedule and contract issues
- f) Supporting material (sample reports, extracts from the
vendor responses to your evaluation). Supporting material
need be provided only if there are specific matters about
which council will require information.

5.8 NEGOTIATING WITH A VENDOR

Upon reaching a final decision, notify the preferred vendor of your intention to proceed, subject to resolving the contract, implementation scheduling and staffing considerations.

You should collaborate with your municipality's lawyer in drawing up the contract. In order to minimize disputes, the following documents should be attached to the contract as appendices:

- . your original statement of requirements and your volume survey,
- . the vendor's written response to your requirements, including his capacity analysis,
- . the agreed upon schedule for implementation.

Finalize any other terms that your lawyer considers should be added, modified, or deleted from the vendor's contract. The terms of contracts for hardware are seldom flexible. However, there are several issues concerning both hardware and functional application software that must be negotiated and then stated in the contract's terms:

- . payment terms including down payments, progress payments and holdbacks,
- . delivery dates,
- . warranties and penalties with regard to the performance requirements to which the vendor has agreed,
- . copyright protection on application software,
- . ownership of software,
- . assistance with installing the system and making it operational, including the conversion of any computer based files you may have,

- . training, and documentation provided,
- . maintenance terms (scope of services and costs).

When the contract has been signed, each of the unsuccessful vendors should be notified and thanked for their participation. You could explain to them in general terms why they were unsuccessful (e.g., lack of proven software, inexperienced staff, inadequate capacity analysis, etc.).

5.9 SERVICE AND MAINTENANCE

Vendor personnel normally carry out hardware maintenance. For software, functional packages should be maintained by the software vendor. Generic packages (e.g., word processing) are usually designed not to be modified by either users or retailers of these packages. Instead, they are maintained by the software creators or producers.

In terms of hardware maintenance, most computers are under warranty for 90 days. If there are any deficiencies in the computer itself, they are likely to show up during this period. They should be corrected at no cost.

Maintenance, as a service, is becoming quite competitive. There are a number of large corporations that service a variety of different vendors' equipment. The cost of hardware maintenance varies by vendor, your location and type of contract.

In terms of software maintenance, any flaws should be fixed by the vendor without charge provided that you are within the warranty period. Beyond this period, you may wish to consider a maintenance contract to provide minor as well as major enhancements (i.e., software maintenance) to meet your changing information needs. You might, for example, want to modify the format of your tax bill to include additional special area rating information. Such work is usually charged on a time-and-expenses basis. Revised documentation, detailing the changes, is a matter to be negotiated with the vendor. Changes are expensive, which reinforces the importance of the package being as complete as possible.

The software producers' usual practice is to fix errors if the program is not performing as documented. There is no charge to licensed users. The producers will supply new releases of the software to licensed users for a fairly nominal charge - generally between 5-20% of the original purchase price. A new release may have enhancements (for example, a spelling checker may be added to a word processing program), and the errors in previous releases should have been eliminated.

5.10 DOCUMENTATION

Documentation

The documentation for your computer system is your silent data processing manager. It's worth re-emphasizing the importance of having on hand the vendor-supplied manuals for the application programs, the operating system, and the hardware, plus the documentation that you produce, detailing your own office's routines. This material should be housed close to the computer.

Each person who will be operating the computer should be required to read the operator documentation before trying to use the computer for the first time. Also, inexperienced users should refer to the manual when learning how to correct error conditions. About half the service calls that both hardware and software vendors receive concern problems that could have been resolved through users consulting their manuals.

Security

Because microcomputers are small, they are quite easy to steal. Because they are comparatively easy to use, both the programs and the data stored in the microcomputer are vulnerable to misuse - either accidental or deliberate. Provision should be made to ensure the security of the equipment, data, and documentation.

6.0 IMPLEMENTATION, CONVERSION AND OPERATION

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6.1 SCHEDULING AND RESPONSIBILITIES

If defining your computer requirements resembles the planning that you do to build a house, the planning for implementation is like planning your move into the house. You will need a comprehensive list of what has to be done, when, by whom, and when each task will be finished. Don't schedule things too tightly. You will need time in hand to allow for the unforeseen and for people to adjust to all the changes.

The easiest approach is to start by confirming the sequence in which the applications are to be installed, taking into account the critical dates, e.g., when tax bills are to be issued. You don't want the computer to arrive in the middle of your peak period.

While an application is being installed, the existing system has to be kept going - so the computer installation means that extra work has to be done. This extra work must be kept in mind when you are scheduling the implementation tasks and their sequence. From this overall plan, a detailed schedule can be developed for each application.

Functional Packages

Exhibit 3 presents a list of the major tasks to be done when installing functional packages, and a schedule for accomplishing them. Note that timing will depend on your environment - how complex the application is, how much modification is necessary, what skills your staff has, etc.

Generic Packages

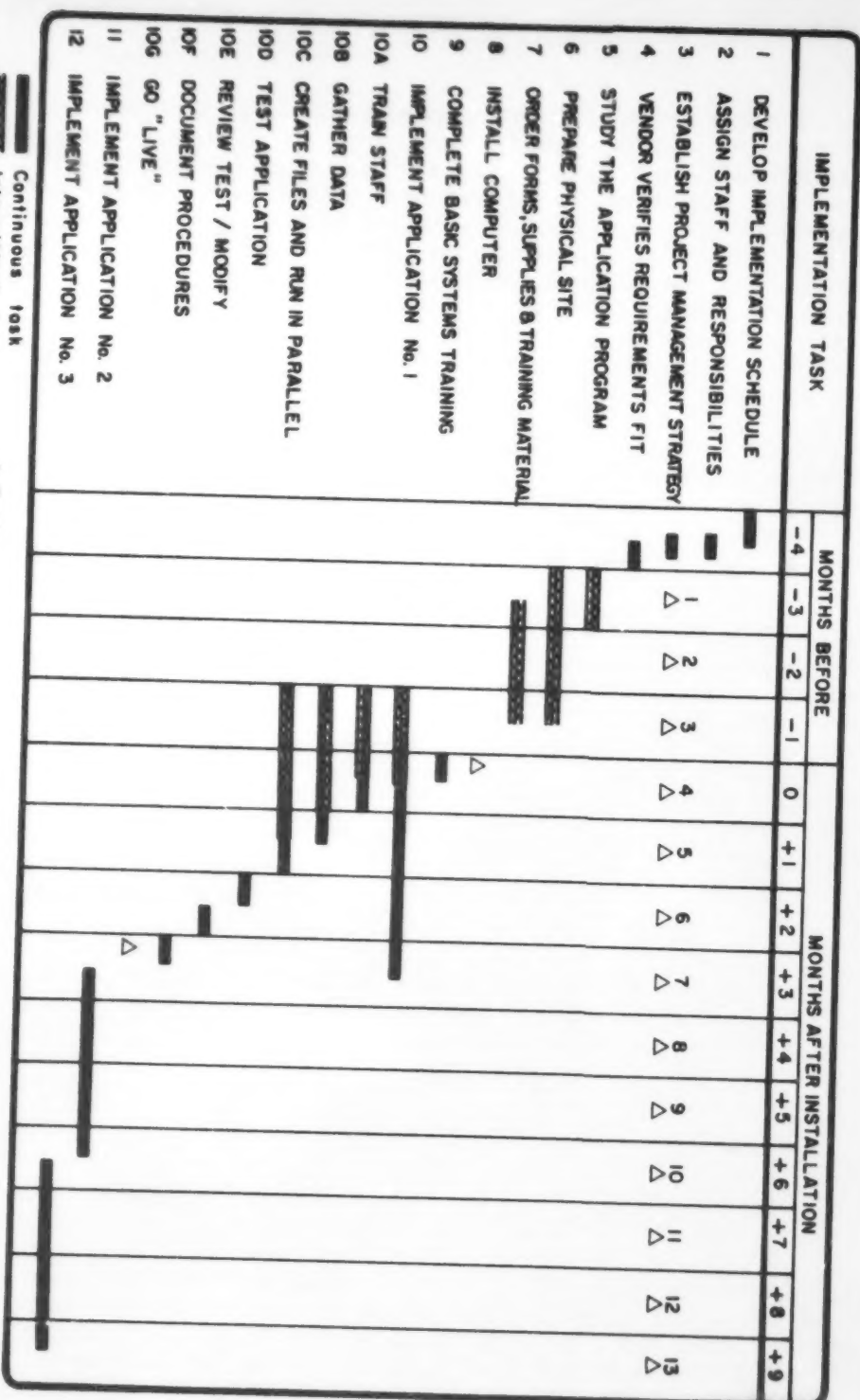
If you are planning to do a little light word processing, you could consider introducing word processing first. It is not shown on the sample schedule in Exhibit 3, but could quite easily be commenced after steps 8 and 9 are completed. There are advantages to learning how to use the word processing package before attempting the functional applications. It will familiarize the operator with the computer, it can be

learned quickly, and it will put your machine to work immediately. On the other hand, you will have plenty to keep you busy while getting ready for the functional applications, so you may not want to divert your efforts to this use of the computer.

EXHIBIT 3

SAMPLE IMPLEMENTATION SCHEDULE

Implementation 65A



NOTE: TIME LINES SHOWN ARE FOR ILLUSTRATIVE PURPOSES ONLY AND DO NOT REPRESENT ACTUAL OR SUGGESTED TIME LINES.

6.2 SITE PREPARATION

Electricity

Electrical requirements vary depending on the size of the computer. A microcomputer for example will operate on standard 110-volt AC power. It is best to have a separate circuit-breaker and line from the control panel to the electrical outlet you will be using. The circuit-breaker should be labelled, so that someone does not accidentally throw it when you are halfway through a big job. If your electrical power is inclined to surge, you could install power filtration equipment or voltage regulators, available from computer stores. This will prevent processing errors or physical damage that can be caused by surges. Light bulbs may tolerate flickering; computers commit a quick and quiet suicide at the first little burp in power.

Location

The computer does not belong in an inaccessible, dark corner of the office where it is hard to get at and use. Heat will probably build up if it is located in a small, unventilated room. Nor should it be placed in the direct glare of sunlight (it makes the screen hard to read). You may wish to locate it near a telephone so that you don't have to leave in order to take or make telephone calls.

Do not place your computer on a carpet, since the static build-up can cause equipment failures. If this is unavoidable, place the machine and its furnishings on a grounded, anti-static mat. It is also a good idea to keep the computer and your supplies in a reasonably humid environment (this may require a room humidifier in winter). The computer and its surroundings should be kept as dust free as possible.

6.3 TRAINING

Most hardware vendors supply some form of basic systems training material on how to use the computer. These manuals show how to install and operate the computer. Approximately two weeks should be allowed for this training to ensure that the project manager and the operator have mastered the basics before starting work on implementing the applications. Be prepared to devote a reasonable block of time to training. Experienced users have found that trying to train operators for half an hour here and another hour there doesn't work.

Study the documentation closely. The aim is:

- . to become familiar with precisely what is to be input and in what format, what processing steps will be followed, and what output will be produced, and
- . to compare the input, processing and output with your present procedures.

The information entered has to be exact. For example, you cannot leave out the postal code when you are entering an address. Also, information must be entered in the prescribed sequence and form - which may be quite different from those used in your existing files.

Unlike people, computers are not tolerant of departures from prescribed practice, or of "little" mistakes. Everyone has read newspaper stories about, for instance, telephone subscribers receiving monthly telephone bills for astronomical amounts. The same thing can happen to taxpayers' bills as a result of those "little" mistakes. Transferring tasks to a computer entails looking at your present and future office procedures with a magnifying glass. "Front-end" effort will pay off in a smooth transition to automated systems that perform the way they are supposed to perform.

6.4 INSTALLATION

Depending on what you have arranged, the vendor may deliver and hook up the computer and its peripherals. If this hasn't been arranged, the operating manual should explain how to connect the pieces of equipment. Carefully read the instructions before turning the machine on for the first time.

6.5 CONVERSION

With larger types of computers, file conversion and training commonly begin before the computer is installed. Not so with microcomputers. It is usually more convenient and less costly to install the computer in your office before doing any application training and file conversion.

6.6 IMPLEMENTATION

Create Files and Run in Parallel

With the application program loaded into the computer, enter the fixed data into the computer and then the transaction data. Now you are ready to start running the computer system "in parallel" with your existing system - that is, the two systems run side by side until you are satisfied that the new system is performing as it should. While operating in parallel, use blank paper (not custom forms) for printing the computer's output. You certainly don't want to produce duplicate cheques - or any other duplicate records.

There are two useful alternatives to parallel running with current operations. One of these is to enter detailed transactions for some past period or part of a past period, run the program using these data and then check the results against those obtained for that period using the old system. The main advantages of this procedure are: 1) you can do the run outside peak workloads, 2) you are paralleling work known to be accurate and 3) you are creating historical files that you may require in any event. This approach is called an historical parallel run.

Another method of testing is to select only part of a file for parallel running under either method described above. While not as comprehensive as the other two methods, this partial running has the advantage of requiring less staff time than the other methods.

Document Procedures

It is imperative that the procedures for the computer systems in your office be written down. Step-by-step descriptions must be documented and kept up to date, specifying:

- . how to run the application (computer operations documentation),

- . how to prepare and correct input,
- . how to use the computer's output.

Good documentation makes it easy to carry out procedures consistently and ensures continuity.

Go "Live"

Once you can successfully reconcile both the old system and your new computer system, and you can trace all errors to the old system for an accounting period, you can go "live". Proper verification and parallel testing of a proven package should take from one to two months, provided that your staff has been properly trained.

Implement Other Applications

After the initial application has been successfully installed, the other applications can be implemented in your predetermined sequence. Municipal people have generally found that attempts to proceed at a fast pace, particularly with few staff, result in problems, as staff are not thoroughly familiar with one application before starting the next.

Before commencing the installation of the next application, it is worth reviewing the installation just completed. You will undoubtedly have learned some valuable lessons that can then be applied to subsequent implementation efforts.

6.7 OPERATION: BACKUP AND CONTROLS

When the implementation activities have been completed, most people feel a lot more confident about using the computer successfully. The vendor's training material and operating manuals give you the "hands-on" information you need to operate your system.

Backup Procedures

Most people wouldn't dream of driving a car any distance without a spare tire. A backup operator and backup copies of all data files and programs are the equivalent of the spare tire. It is strongly advisable to have a trained backup operator who can take over when needed. This is particularly important in smaller municipalities.

A file that may take hours or days to create can be wiped out by equipment or disk failures, power failures, or program or operator errors. By following the software vendor's instructions on making backup copies, you will avoid the real danger of losing a lot of work. And backup copies take only minutes to make when done daily. You may spend about an hour at the end of the week performing a complete backup of all system files and programs. This is time well spent.

The daily or weekly backup copies of all files should be stored at some other, safe location, such as a bank deposit box or at your home. A copy of all programs and all documentation should be stored off-site as well.

A backup taken while processing a long job, such as creating the budget using an electronic spreadsheet, is also recommended. Experienced computer operators will stop every couple of hours and take a few minutes to make a backup copy in case something happens to destroy their work.

It is not necessary to have a backup computer. However, you may want to make arrangements with another municipality or organization in your area that has the same equipment as yours, should an emergency arise.

Operating Controls

The computer makes it practical for a single individual to carry out all accounting tasks in a small municipal office. However, external auditors may be concerned about separation of duties, i.e., one person should not be responsible for processing all of the financial information. If this concern applies, a solution in an office with more than one staff member is to ensure that all balance and edit reports and journals (with appropriate balancing totals) are reviewed by a second person. Occasionally, the edited reports should be verified against the original source documents by a second party. The balancing control totals, number of errors and file names should be recorded in the log.

6.8 BREAKDOWNS

When an error occurs, or some part of the system fails, the following steps will help to get the computer going again as soon as possible.

1. Write down the specific error message, and note the exact conditions under which the failure occurred. The vendor's service staff will need this information when diagnosing the problem. They will also want to know the equipment serial number.
2. Refer to the error condition codes in your manuals to see if you can determine the cause of the problem.
3. Make sure that all plugs, connections and circuit boards are properly connected, particularly if you have just moved the equipment or installed new devices.
4. Before sending equipment in for repair or having someone sent to your offices, telephone your usual vendor support person. Explain the problem and what you have done to try to correct it. The problem can often be resolved over the phone.
5. If the vendor must see the equipment or programs, obtain a definite commitment as to when the service will be performed.
6. If the failure has not been resolved after two service calls, explain your concern to the vendor's management and ask for a more experienced person to be assigned.

Diskettes

If diskettes are to give long service, a few handling tips should be followed.

1. Keep away from extreme heat (+40C) and cold (-0C). Extreme temperatures cause the film to warp. Make sure that the diskette is at about room temperature when you use it.

2. Keep away from strong electrical or magnetic sources (e.g., motors, telephone bells, static). These destroy the data on the surface. Do not put the diskette near a magnetic paperclip holder; don't put paperclips on or near the diskette either. They can damage the data.
3. Keep diskettes in jackets, protected from dust, smoke and other contaminants.
4. Don't touch, bend or scratch the recording surface of the diskette.
5. To avoid damaging the diskette's surface, don't write on the diskette jacket with a hard-tipped pen or pencil.
6. Use your diskettes in a cycle so that the same diskettes are not in constant use. Alternating between active and backup use will prolong the diskettes' life.
7. Keep your diskette drives well aligned. Moving the diskette drive equipment can cause misalignment. Ask your vendor and refer to the manuals about any special precautions to be taken when moving the equipment.
8. Don't remove the diskette while the drive is operating (when the red light is on). Doing so can score the surface of the diskette.
9. Avoid buying mail order or lower-priced diskettes unless you know that experienced users are satisfied with their quality.

7.0 LEGAL ISSUES AND CONTRACTS

The Negotiating Arena

The essentials of the negotiating process must address all of the user's concerns, which should be included as fairly high priority items. These should be addressed initially and throughout the entire negotiation process with a view to incorporating them into formalized agreements.

Contract negotiations should be initiated at the very outset of the proposed acquisition process. Suppliers should be made aware, in all meetings and in all Requests for Proposals (RFPs), that any proposed acquisition by the user with that particular supplier must be documented in writing, by a contract acceptable to both parties. This immediately alerts the supplier to the fact that his standard form of contract may not necessarily be the one which will be used. Each supplier should also be requested to furnish copies of all the standard forms of contracts he would propose having the user execute, should a deal be signed. It is important to ensure that the supplier provides copies of ALL of the contracts including sales, licensing, maintenance and hardware agreements at the beginning. This helps avoid any misunderstandings or delays in finalizing the arrangements later on.

Assuming that the user has, in reply to the RFP, received proposals for evaluation, he will undoubtedly attempt to evaluate these proposals - with some consultative help. This process will, of necessity, require clarification and negotiation with the various suppliers.

Assuming that the user has properly identified his needs, both the user and the supplier must also identify and resolve such items as:

Specified individual responsibilities of both the user and supplier, so as to avoid any future misunderstandings. These responsibilities should be documented; in fact, they should form part of the implementation documents.

- Development of and agreement on the implementation plan and schedule. Both the supplier and the user should direct their efforts towards developing and living within realistic time frames, rather than looking towards a wish list.
- Identification of some type of price protection on subsequently acquired peripherals.

Contract Documents

The following agreements should be considered. In many installations, depending on the circumstances, they can be consolidated into one or two documents.

1. Hardware sales agreement

In this stylized document, most often presented as the hardware supplier's "standard form of contract", the user becomes somewhat bewildered and troubled by the blend of 'legalese' and 'computerese'. The style of document may be a single page, the front side of which is typically nothing more than an order form for the hardware, and accompanied by the user's agreement to comply with all the terms and conditions contained on the reverse side. When turned over, the document provides for the terms of payment (usually upon delivery or within a very short period thereafter), some type of permission from the supplier (or as an extension of the owner of the operating system) to use the operating system and the system software supplied with the hardware. The balance of the document comprise a series of paragraphs, in bold print, excluding the supplier from all kinds of responsibilities, liabilities and obligations to the user. At the other end of the spectrum, the form of hardware agreement may extend from 12 to 20 pages, reduced to very fine print (often requiring a very large magnifying glass to be read)!

The user will approach the review of this document with all the flare and excitement that would show in reviewing the terms of a typical insurance policy.

2. Operating system licence and licences for any other system software, including utilities, compilers and interpreters

Although the user acquires legal title and ownership to the hardware, the user's rights with respect to the operating system, utilities, compilers, interpreters and other system software are of a more limited nature. The user is provided with a non-exclusive, non-transferable right to use these items under the terms of a licence (often included as part of the hardware purchase agreement and at other times provided as a separate document). It sets out the terms and conditions under which the user is entitled to use the items required for operation of the hardware and consequently the applications programs. The terms of the licence must be carefully scrutinized, especially with respect to:

- . length of term;
- . rights of termination; and
- . transferability on sale of the hardware.

Among some of the concerns a user might have with regard to the operating system and system software are the following:

- . Are the terms of the licence set out in writing?
- . What restrictions are there regarding the use of the operating system and system software?
- . Is use restricted to a single computer (usually designated by serial number) and, if so, does the right to usage pass along to any purchaser on any subsequent resale?
- . Is the most recent version or release of the operating system and system software included, and does the licence entitle the user to update? Furthermore, is the user compelled to use updates? (The applications software may not be compatible with some vendor-supplied enhancement or modification to the operating system or system software.)
- . What responsibilities are imposed upon the user to protect any proprietary rights of ownership? Are they realistic expectations?

3. Applications software agreement

One of the most neglected issues in the acquisition of software by a potential user is the failure to properly define certain items, including those identified under this heading. Many problems arise because the software supplier may furnish nothing more than a copy of its programs on tape, disc pack, disc, etc., without indicating to the user, in writing, the precise nature of what is being supplied and the terms of use.

Among the issues to be addressed are the following:

- . What are the precise rights being acquired by the user? (That is, is the user purchasing the software outright, and if so, does that entitle him to ownership of the

copyright or any other proprietary interest rights in the software?) This obviously becomes a concern in custom-designed applications.

- . Is the user acquiring only a limited right to use (perhaps by way of licence or rental) the applications software?
- . Are there any restrictions on the use of the applications software by the user, and if so, what are these restrictions? Can the applications software be used by this particular user and no other? Are there geographical limitations on use?
- . What rights of termination exist with respect to the use of the software by the user?
- . What is the nature of any warranties?

4. Software support issues

A further area where both supplier and user sometimes fail to properly address their respective obligations is the area of software support. Once installed, the applications software will undoubtedly require ongoing support; this is normally provided by the software supplier on either a time and material basis, or through periodic regular payments. Regardless of the method of payment for such support, the issues which must be addressed and put in writing, include the following:

- . Detection and correction of coding errors.
- . Availability to the user of all revisions and enhancements.
- . Procedures for initiating corrective action.
- . Times during which services are to be made available.
- . Availability of emergency service and schedule of additional charges.
- . Procedures for responding to user-originated requests.
- . Obligation to maintain confidentiality of the user's business and financial information, including data.
- . Rates of charge for designated categories of individuals (i.e. the user is charged at a lower rate for a junior programmer than for a senior systems analyst).

5. Hardware maintenance agreement

Normally, the hardware supplier will have available its own form of maintenance agreement which is often produced for signature at the same time as the hardware sales agreement. The fact that it is produced for signature at such a time should not mislead the user into believing that it must be

signed then. Only when the user is satisfied that he has struck his best deal - reflected in writing to his satisfaction - should the relevant documentation be signed.

Some of the issues the user may wish to address, by way of revision or addendum to the hardware maintenance agreement, might include the following:

- . Guarantee that hardware maintenance will be made available for the user's particular configuration for a minimum period of time; for example, eight to 10 years.
- . Assurance to the user that he will receive the most favorable pricing for hardware maintenance throughout the term of the agreement.
- . The user's right to cure any default occasioned by him during the term, before the supplier is entitled to exercise rights of termination.
- . Negotiation for guaranteed annual maximum increases in the maintenance charge.
- . Assurance that a certain level of service will be maintained throughout the term.

8.0 FUTURE TRENDS

The rapid growth in the use of computers leads prospective first-time buyers to draw opposite conclusions. Some people respond with: "I'd better buy one and learn how to use it as soon as possible". Others take the view that "things are changing so rapidly, I had better wait and see how the computer industry shakes out before I try to use this new technology".

Both points of view seem to have merit. There are undeniable benefits to be gained from installing a municipal computer. On the other hand, the "wait and see" approach also has merit: hardware and software are going to improve in quality, performance and ease of use - and all at a lower cost.

The trouble with this latter approach is that you could "wait and see" permanently. The technology will not stop changing and improving. By delaying the purchase of a computer simply on the grounds that anything you buy today will be obsolete tomorrow is to miss the point. There are two overriding questions: Will you get a payback from the equipment that is available now, and will the equipment serve your purposes? If the answer to both questions is yes, then it does not matter that more advanced models are coming along all the time. Therefore, the purchase of a computer need not be postponed on the grounds of potential obsolescence. You may delay the purchase on other grounds - your preliminary investigation may show that a computer is just not practical for your municipality right now.

What does the accelerating change in technology mean to you as a potential first-time computer user or as a computer user a couple of years down the road? This question is dealt with from the perspectives of obsolescence, the marketplace, technology, and the evolving role of computers.

Obsolescence

As a potential user, you should go with the vendor who offers the application software that most closely meets your primary applications requirements.

As a current user who has achieved a payback from your computer, you need not be concerned that your system has become or may soon become obsolete. Upgrading to more advanced equipment should be considered only as the newer applications and capabilities will pay for themselves.

Marketplace

Many industry observers think that IBM, IBM-"clones" (microcomputers that are compatible with IBM systems and software in varying degrees) and Apple will dominate the general-purpose microcomputer market - primarily because of the amount of software available for them. Other vendors are predicted to be successful only if they have unique, proprietary application software to meet the needs of markets that the major vendors do not consider attractive.

The municipal market seems to reflect the approach that application software is the first consideration. The hardware being purchased by municipalities is equipment that can run the chosen software. This hardware may or may not be a dominant make. Its "popularity" is not and should not be a concern to the municipal user. Popularity should be taken into account only if the chosen software can run on several different makes of computer, and even then there are more important concerns - vendor support, maintenance, reliability and the like. Popularity in the general marketplace does not automatically guarantee good support in a specific marketplace (i.e., small municipalities). Nor is popularity necessarily a reliable indicator of the vendor's stability or commitment to the market.

Technology

Computer vendors will develop new applications and functions to take advantage of the increased capacity, capability and economy of the hardware. An increasingly wide range of generic packages will become available. Many of these packages will be designed to process text (words) as opposed to numbers (data).

Tomorrow's office computer will be slightly smaller and cheaper but much faster, much more powerful, and reliable, and much easier to use. Computer systems will also integrate office technologies that are currently separate, such as telephones, photocopying/fascimile, video, micrographics, etc.

The Evolving Role of Computers

The microcomputer will become a primary office tool. It will be used both as a standalone unit and as a terminal linked to a mainframe or a minicomputer, or to a local area network (LAN). The LAN will connect it to other computers or to office equipment such as word processors or photocopiers.

It will also be possible to connect it within seconds to:

- . local area networks of other agencies,
- . remote mainframe networks,
- . public data banks.

In time, even the smallest municipalities will probably want to be linked to a local area network or to remote networks of one kind or another.

A GLOSSARY OF TERMS

The Glossary lists words that appear in the text of the Guidelines that you are likely to encounter in reading about and using computers.

ACCESSORY see Peripheral.

ACOUSTIC COUPLER A modem into which the telephone handset is inserted during transmission of data between computers.

APPLICATIONS SOFTWARE The collective name for the class of computer programs that are designed to carry out specific tasks, e.g., processing the payroll, accounts receivable, general ledger.

ASYNCHRONOUS Refers to the transmission of data in a manner that does not require the sending and receiving devices to be synchronized. Each character to be transmitted is separated from the next character by a start and a stop bit. There may be pauses between the transmission of one character and the next. Asynchronous data communication is thus comparatively slow, usually running at speeds between 300 and 1200 bits per second.

AUDIT TRAIL Records created during the processing of information so that items can be traced to their source, and the processing steps can be verified.

BACKUP Equipment, files and procedures that are available if the original units are destroyed. May also refer to an operator who takes over when the regular operator is not available. Used as a verb to mean the process of making a duplicate copy of stored data or programs as a safety precaution.

BASIC (BEGINNER'S ALL-PURPOSE SYMBOLIC INSTRUCTION CODE) A fairly straightforward programming language, used frequently by programmers to write microcomputer and minicomputer application programs.

BATCH PROCESSING Input items, e.g., invoices, are accumulated over a period of time and are then processed as a batch during one machine run. Unlike interactive processing, the operator usually does not communicate with the program during batch processing.

BAUD The unit for measuring the speed with which data are transmitted between computer devices. 300 baud means that 300 bits of data (or about 30-38 characters) are transmitted per second. Common rates are 300 to 1200 baud for slow-speed telephone communication between micro and other computers.

BINARY A numbering system in which each digit represents a power of two. (In contrast, a decimal digit represents a power of 10.) In binary, all digits are either 1's or 0's. Thus, the decimal number 8 is "translated" into binary as 1000, decimal 4=binary 100, decimal 2=binary 10, etc. Binary is the numbering system used by most computers.

BIT Abbreviation of binary digit, the smallest unit of information that a computer can read and understand, represented in a binary form as a 1 or a 0. It takes 7 bits to represent a decimal digit or an alphabetic character using ASCII codes. In ASCII seven bits=1 byte. An eighth bit, called a parity bit, is usually added.

BOOT To get the computer ready for use by loading the operating system. A "bootstrap" program, usually found in ROM, loads the operating system into RAM from disk. The operating system then takes over control of the computer's operations.

BUFFER A storage area used to hold data until it can be used. The buffer is used to compensate for differences in the rates of data flow or in the timing of transmission of data between input/output devices.

BUG An error in the logic of a program or a malfunction in the hardware. See also Debug.

BYTE A group of (usually) eight bits of data which the computer handles as a unit. A byte is used to represent one character, and is, for most purposes, the smallest unit on which the computer operates.

CAPACITY Denotes the amount a computer can handle. With regard to memory, capacity means the amount of data or the size of the program that the internal memory can store at any one time. With regard to the printer, capacity means the number of characters or lines a printer can produce in a

given time. Thus, capacity, in contrast to capability, usually refers to some aspect to the computer's performance that can be measured.

CARD A printed circuit board (PCB) that contains the computer's electronic components, e.g., chips, and the electronic circuits needed to connect them. The card is plugged into the motherboard, or main hardware board of the computer.

CASSETTE Small, limited-capacity tape unit used as a storage medium for programs and data files on home computers. Cassettes, like audio tape cassettes, are too small, slow and unreliable to be used for office computer applications.

CENTRAL PROCESSING UNIT (CPU) The microprocessor, located on the motherboard or main PCB, that performs arithmetic, logic and control operations. It also includes an instruction decoder, program counter, clock, and other elements.

CHARACTER A single letter, number or symbol. May also be called a byte, since one character is represented by one byte or eight bits in most computers.

CHARACTERS PER SECOND see CPS.

CHIP (OR INTEGRATED CIRCUIT) A small silicon wafer that contains from a few dozen to tens of thousands of electronic circuits for storing and processing information. The chip is housed in an integrated circuit. There are microprocessor chips and memory chips.

CIRCUIT Any path along which electricity can flow. In a computer, a circuit is an electronic device that performs a predetermined function.

CLONE Refers to computers designed by their manufacturers to resemble some other make of computer. Clones are compatible in varying degrees with the computer being emulated or with programs written for that computer.

COBOL (COMMON BUSINESS ORIENTED LANGUAGE) An acronym for a programming language widely used for business applications. Instructions in COBOL are much like English and therefore readily understandable.

CODE Symbolic representation; often used as a "shorthand" way of referring to computer program instructions, e.g., "That programmer writes good code (i.e., programs)".

COMMAND An instruction to the computer, e.g., Go to. Some keyboards have command keys, for frequently used instructions, e.g., print. A command may call a few lines of program instructions, an entire program, or a group of programs.

COMPATIBILITY The ability of two or more things to be used together. Compatibility exists between two computers if programs and data can be run on both without any changes having to be made. Also refers to the ability of various hardware components (e.g., input/output devices and the computer) to be used together.

COMPILER A complex series of programs that "translates" program instruction written in a high-level, English-like programming language (called the source program) into machine-language instructions. Each programming language requires its own compiler, unless the language is interpreted. (See Interpreter.)

COMPUTER Refers to a general-purpose device that can process large volumes of data electronically, has a central processing unit and input/output devices, and is controlled by a series of predetermined instructions called a program.

CONFIGURATION Several pieces of equipment make up a working computer installation - the central processing unit (CPU), input/output (I/O) devices such as disk drives, storage and so on. The particular combination of pieces of equipment in a given installation is known as its configuration.

CONSOLE The computer component from which the operator controls the actions of the computer, normally consisting of a keyboard and a CRT.

CONVERT To change from one form or state to another. For example, the manual procedures for carrying out a function may be converted to computerized procedures. The entire process of changing the procedures is referred to as conversion. An organization may also convert its computer installation, meaning that a major change is made, moving from, say, a microcomputer to a minicomputer or from using a service bureau to an in-house computer. See also Parallel Conversion.

CP/M (CONTROL PROGRAM FOR MICROCOMPUTERS) An operating system manufactured by Digital Research Inc. used in many microcomputers. Some computers require special cards to operate CP/M. CP/M is widely used as the operating system of 8-bit microcomputers.

CPS (CHARACTERS PER SECOND) The rate at which slower-speed printers produce output. They print only one character at a time. Compare with LPM. (120-150 cps is equal to 50-60 lines/minute or a full page of computer printout.)

CPU see Central Processing Unit.

CRASH Slang for a computer breakdown. See also Head Crash.

CRT (CATHODE RAY TUBE) A video display device resembling a television screen, on which information is displayed. It is linked to the keyboard and to the central processing unit. CRT is often used as a synonym for 'terminal', thus referring not only to the display device but also to the keyboard. Video display terminal (VDT) and video display unit (VDU), and monitor are synonyms for CRT.

CURSOR A pointer or marker on a CRT that indicates the position on the screen where the next input character will be displayed.

CUSTOM PROGRAM A non-standard or custom program is one specially written to meet the particular needs of one user.

DATA Any information that the computer receives as input, processes in some way or stores, and outputs via a screen or printer. Data may consist of letters, words, numbers, or symbols.

DATA BASE A collection of files stored in the computer in such a way that information can easily be accessed, retrieved or re-arranged. A data base contains information on a particular topic or topics, e.g., a financial data base would include files on the chart of accounts, the general ledger balances and the financial posting details. An integrated data base seeks to store each piece of information only once, regardless of where it comes from or how it is to be used.

The hierarchy for organizing information in a data base is as follows: the data base consists of files; each file contains related records, e.g., a record for each tax payer's account; each record is divided into fields or data elements; each field contains a group of logically related characters or bytes, e.g., a taxpayer's name. See File; Record; Field.

DATA BASE MANAGEMENT SYSTEM (DBMS) A comprehensive and generally very complex program for accessing, reading, controlling and maintaining large, integrated data bases.

DATA BASE PACKAGE A packaged program that allows the computer user to store information, arrange it in a chosen order, search it, update it, display it and print it out. (Such packages should not be confused with Data Base Management Systems.) Simpler versions of data base packages are sometimes called file managers. They usually manage only one file at a time. Inquiry packages are another type of data base package, enabling the user simply to request information from the computer. Templates are available for some data base packages. See Template.

DATA COMMUNICATION The transmission of coded data by electrical signals over any one of a variety of media, e.g., telephone lines, co-axial cables, microwave, satellites.

DATA ELEMENT see Field.

DATA ENTRY The activity of putting data into the computer by means of an input device (usually a keyboard).

DATA PROCESSING see Electronic Data Processing.

DBMS see Data Base Management System.

DEBUG The activity of solving problems caused by errors or omissions in a program or malfunctions in the computer hardware. (See also Bug.)

DECISION SUPPORT SYSTEM A series of application programs that are used to analyse alternatives to help an individual make a decision, e.g., spreadsheet and modelling packages.

DEGRADATION The slowdown in the computer's response time because the computer has been overloaded by the operator trying to do too much work concurrently.

DENSITY The number of units of information that can be packaged into or stored within a given physical dimension on a magnetic storage medium, e.g., 1600 bits per inch.

DESKTOP COMPUTER A computer used for office purposes with all hardware components normally being located on top of a desk. "Desktop" distinguishes these microcomputers from "portable" microcomputers that can be used anywhere and normally weigh under 30 pounds (excluding a printer). Desktop computers can be moved, but are not readily portable.

DEVICE A piece of computer equipment (e.g., disk, printer, modem).

DIAGNOSTIC A program designed to check the operation of a computer component or a program for errors or malfunctions and to report its findings via a message.

DIRECT ACCESS see Random Access.

DISK (OR DISC) A means of storing data magnetically on a device that looks much like a gramophone record. The data on the disk can be retrieved randomly. See Diskette; Hard Disk; Random Access.

DISK DRIVE A device which holds the disk and rotates it. (Diskettes have to be inserted into it.) The disk drive is linked to the computer, enabling information on the disk to be transferred to the computer and information from the computer to be recorded on the disk.

DISK OPERATING SYSTEM see DOS.

DISKETTE, OR FLOPPY DISK A small, flexible disk that stores information or data magnetically. Floppy disks vary in size: 3"-3.9" (micro-floppy), 5 1/4" (mini-floppy) and 8" (floppy). Capacity varies from 100 KB to 1,200 KB.

DISPLAY DEVICE (OR UNIT OR SCREEN) Synonyms for the CRT.

DISTRIBUTED DATA PROCESSING The use by an organization of more than one computer in more than one location to carry out the organization's data processing. Thus, the data may also be stored in more than one place. The computers are linked by communications lines. This decentralized approach can be contrasted with the use of a single computer in a single location, or centralized processing.

DOCUMENTATION A collective name for all the documents (written records) that give information about something, e.g., the operation of a computer, or all the instructions that together make up a program. To document means to record something in writing. A computer's documentation usually means all the literature provided with the equipment to assist the purchaser in using it.

DOS (DISK OPERATING SYSTEM) A program that controls the computer and enables the application programs to interact with the hardware devices (particularly the disk) so the data can be moved, stored and processed. Used in computers that employ disks as the mass storage medium. Some computers have a built-in DOS; others require a DOS to be loaded into the computer memory from disk before application programs are loaded.

DOT-MATRIX PRINTER An inexpensive printer that creates characters by combining dots.

DOWNTIME The period during which a computer is not functioning, usually because of a hardware or software problem.

DUMP To transfer the contents of the computer's main memory to a peripheral device (the printer or the disk or the CRT).

EDIT To look for errors, which the user then corrects. The data are then ready for further processing.

ELECTRONIC DATA PROCESSING The electronic processing of data by a computer, including input, calculations, storage and output. (Data can, of course, be "processed" in many other ways - the human brain processes data continuously.)

ELECTRONIC MAIL A means of sending messages electronically, via computers that can communicate with each other.

ELECTRONIC SPREADSHEET An interactive computer program that allows the user to use the CRT as a spreadsheet. The program provides a grid of columns and rows. The relationships between the data to be entered in the columns and the rows can be specified by the user. The program then manipulates the columns and rows of numbers automatically. If one number is changed, all other related numbers are automatically changed. Spreadsheet programs thus require the user to do a fair amount of preliminary work. Templates are available for some spreadsheet programs. See Templates.

ERGONOMICS The scientific study of the relationship between human beings and machines and the effects of this relationship on human performance. Also known as human factors engineering.

EXECUTE To carry out the instructions in a program, i.e., to run the program.

FACSIMILE A process whereby images are transmitted electronically, usually over some distance. The image is scanned, converted into digital signals, sent via a communications line, and reconstructed as a duplicate of the original image at the receiving station. Sometimes called fax.

FIELD A sub-division of a record, i.e. a group of one or more related characters and/or numbers stored in a computer record. A record will have several fields, e.g., name, address, postal code, and telephone number are fields in a taxpayer's record. See also Data Base.

FIELD UPGRADEABLE Refers to a piece of computer hardware or software that can be upgraded at the customer's site without being physically replaced. (Equipment that is not field-upgradeable usually has to be disposed of, and completely new equipment has to be purchased to replace it.)

FILE A file consists of collection of related records, e.g., an employee file has a record for each employee. See also Data Base.

FILE MANAGER see Data Base Package.

FIRMWARE The software stored by the computer manufacturer in ROM (Read Only Memory). Some frequently used programs in the operating system are stored in ROM, so the computer will not have to load them from the disk to execute them. The computer can therefore run faster.

FLOPPY DISK see Diskette.

FLOWCHART a pictorial representation of the steps in a program, or of a solution to a problem.

FONT A set of printing type in one particular style (e.g., Helvetica, Pica, Executive, etc.) and size.

FORTRAN (FORMULA TRANSLATOR) An early high-level computer language still in wide use, particularly for mathematical, scientific and engineering applications.

FUNCTION KEY A key that causes the computer to perform a predetermined function, e.g. Help, Delete, etc.

FUNCTIONAL PACKAGE Refers to packaged programs that carry out organization functions e.g., the accounting and payroll functions. Such packages are often designed to meet the needs of a particular "sector", e.g., local government, automobile dealers, fast food restaurants, etc. (Packages designed for particular industrial sectors are sometimes called vertical market packages.) Contrast with Generic Package.

FUNCTIONALITY see Capability.

GENERIC PACKAGE Refers to packages that can be used by any organization of any size in any industry, e.g., electronic spreadsheet or word processing packages. These packages are sometimes called personal productivity tools or horizontal market packages, i.e., they fit into any industry. Contrast with Functional Package.

HARD COPY A record of computer output printed on paper.

HARD DISK A disk made of aluminum and covered with magnetic metal oxide, capable of storing 5 million bytes or more, sealed in plastic to protect it from dust. Most hard disks cannot be removed from the disk drive, but removable disks are becoming more common. Often called a Winchester disk.

HARDWARE The physical pieces of computer equipment.

HEAD CRASH When a read/write head touches a disk spinning at high speed and destroys the data. Usually the result of the head becoming misaligned or a power failure.

HIGH-LEVEL LANGUAGES Programming languages that resemble ordinary English. A single instruction in a high-level source language translates into many machine-language instructions.

INFO GLOBE A data bank owned by the Globe and Mail that contains articles reported in that newspaper. It is accessible on line to subscribers.

INFORMATION Any data that can be coded for processing; data organized in a meaningful manner that meets a user's needs.

INITIALIZE To get something (a program or a disk) ready for use.

INPUT As a noun, input refers to data that will be processed by the computer. As a verb, to input means to enter data into the computer.

INPUT/OUTPUT DEVICE (I/O DEVICE) A piece of equipment that feeds data into or takes results from the computer. CRT's and keyboards are input devices; printers are output devices.

INQUIRY A request for information that is stored in the computer's memory.

INSTALLATION A collective name for the hardware, software and other computer-related facilities in an organization. Installing the computer means setting it up in a user location.

INSTRUCTION One line of coding in a program, e.g., Add A and B, telling the computer what to do next.

INTEGRATED Applications are said to be integrated if they use common commands and/or common data, or if some of the output of one application is automatically used as input to another. See also Data Base.

INTEGRATED CIRCUIT see Chip.

INTEGRATED GENERIC PACKAGES Software packages that combine several applications. They are capable of carrying out several different tasks using common data. For example, an integrated package may combine a spreadsheet, a graphics program and a data base utility. The output from one task, e.g., numbers produced by the spreadsheet part of the program, is used to carry out another task, e.g., producing graphics.

INTEGRITY The soundness or unimpaired condition of something. For example, the integrity of a computer file refers to its records and data elements being error-free and complete. (Integrity is thus a condition that must be maintained.)

INTERACTIVE A mode of processing that allows the user and the computer to "communicate" with each other. For example, the computer displays a question on the screen, and the user keys in a response, which in turn causes the computer to do something.

INTERFACE A place or point at which two systems meet; in computers, an electronic connection between two computer devices, enabling them to communicate. (This kind of interface is also called a port. See Port.) Also used as a verb to refer broadly to the ability of one thing to interact with another, e.g., the accounts payable program interfaces with the general ledger program.

INTERPRETER A large program that translates an application program written in a high-level language into machine language each time the program is executed. BASIC programs, for example, are usually interpreted rather than compiled. (See Compiler.) Since the instructions must be interpreted

each time the program is run, such programs tend to execute more slowly than compiled programs, which are already compiled into machine language.

I/O DEVICE see Input/Output Device.

K (KILO) Stands for about one thousand units. (Strictly, 1,024 or 2 to the power of 10.) Thus 64K = 65,536. 64 kilobytes is written as 64 K bytes or 64KB.

KEYBOARD A piece of equipment that has keys resembling those of a typewriter, used for entering data.

KEYING The process of using a keyboard to enter data into the computer. Comparable to typing.

LAN See Local Area Network.

LETTER-QUALITY PRINTER A printer that produces fully formed letters, similar to those produced on a typewriter.

LIBRARY A collection of programs used by an organization.

LOAD To read a program from an external storage device (e.g., a diskette) into the computer's main memory for execution.

LOCAL AREA NETWORK (LAN) A system that allows computers within a local area (e.g., a single building) to be linked, so that they can share peripherals such as printers and disks, as well as data and programs. LAN's can be configured in several different ways. A network controller keeps order.

LOGON To identify oneself to the computer. A set of procedures that the user must follow in order to gain access to the CPU. For example, it is usual to enter the user's identification code, called the user ID or userid, and possibly a password.

LOW-LEVEL LANGUAGES These programming languages are in a form that requires little or no translation by the machine, e.g., assembly language. In contrast to high-level languages, they do not resemble English. Programs written in such languages can usually be executed faster than those written in high-level languages.

LPM (LINES PER MINUTE) A means of measuring the speed of a high-speed printer which prints an entire line at a time (e.g., 200 to 2,000 lpm). Such printers are not commonly used with microcomputers. Compare with CPS.

M (MEGA) About one million. A 20-megabyte disk stores about 20 million characters or bytes. 20 million bytes is abbreviated as 20 MB.

MAGNETIC DISK see Diskette; Hard Disk.

MAGNETIC TAPE A medium upon which data is recorded by means of magnetic dots. Records are stored and read in sequence, i.e., they cannot be accessed directly. See Sequential Access and Random Access.

MAIN MEMORY see Memory.

MAINFRAME A very large computer.

MAINTENANCE Maintenance is used to refer to computer hardware and software. Hardware maintenance for microcomputers is usually 'remedial', i.e., the micro is repaired when it fails, as opposed to preventive (equipment is serviced at regular intervals).

Software maintenance usually refers to minor modifications of functional programs to accommodate changes in applications. For example, if labour rates change, then a number of payroll programs have to be changed.

MANAGEMENT INFORMATION SYSTEM An integrated series of programs and data files designed to meet most or all of the information needs of a particular functional area of the organization, or of the entire organization. Compare with Decision Support System.

MASS STORAGE The term used to refer to the devices (disks or tapes) for storing large amounts of data.

MEMORY Usually refers to the main memory, or RAM, of the computer, i.e., the device that stores data and programs, allowing them to be executed by the CPU. Sometimes memory refers to the auxiliary memory of the computer, i.e., disk or tape which is used for mass storage. See also RAM, ROM, Mass Storage.

MENU A list of options (programs, or parts of programs, or records) which the computer displays on the screen. The user can choose the desired option to carry out a function or to retrieve some information. Menus tend to make the system user friendly for a new operator.

MERGE To combine items from two or more sets of information into a single set.

MICROCOMPUTER A small computer with a microprocessor as its CPU and its major circuitry on chips. (Also called a micro.)

MICROPROCESSOR The central processing unit of a microcomputer.

MINICOMPUTERS A class of computers that have more processing power and memory than microcomputers but less than mainframes.

MIS see Management Information System

MODEM (MODULATOR/DEMULATOR) A device that allows computers to communicate with each other using telephone lines by converting the digital signals of a computer into the analog signals of a telephone line and vice versa.

MONITOR Another name for a CRT.

MOTHERBOARD The main hardware board of a microcomputer, into which all other printed circuit boards are plugged. (The motherboard itself is a printed circuit board.)

MS-DOS Disk Operating System produced by Microsoft Inc. for 16-bit microcomputers.

MULTI-PROCESSING/MULTI-PROGRAMMING/MULTI-TASKING These three terms tend to be used interchangeably. There is no universally accepted definition for them. If a computer salesperson uses one of these terms, find out whether he or she is referring to:

- a machine that has more than one microprocessor (this is the most common meaning of "multi-processing"). The number of microprocessors has no bearing on how many applications can be run at the same time.
- a machine that can run more than one application program virtually simultaneously (it could have one or more microprocessors). This is the most common meaning of "multi-programming".

- a machine that can accept keyboard input while printing output from a previously executed program (spooling). This is a specific version of multi-programming.
- a machine that can simultaneously execute two tasks within a single program. This is the most common meaning of "multi-tasking".
- some other capability.

MULTI-USER Refers to a computer that is capable of accommodating more than one operator using the computer simultaneously. Such a computer may have only one microprocessor but several terminals (CRTs and keyboards) and use a multi-tasking, multi-programming or multi-processing operating system.

NETWORK A group of computers and terminals linked to each other by co-axial cables or telephone lines. The network enables computers to send and receive data to share some devices, e.g., printers and disk drives, with each other. See also Local Area Network.

OFF-LINE Not communicating directly with the computer. A mode of processing that involves an intermediate step before the data is entered into the computer. For example, data may be keyed onto a diskettes (off-line). Some time later, the diskette is put on the computer for reading and processing. In a computer that has a hard disk, data and text can be transferred from the hard disk to a floppy disk for storage purposes. Thus the data or text are stored off-line.

ON LINE Communicating directly with the computer and under the control of the CPU and a program. A mode of processing that permits data to be entered directly to the computer, changing the data base immediately. Similarly, information is received immediately from the computer. Anything that is stored on a hard disk in a computer system is stored on-line.

ON SITE At your location, e.g., training or maintenance may be conducted on site.

OPERATING (OR SYSTEM) SOFTWARE The programs that are necessary to keep the computer running as automatically as possible. They do not actually process anything - that is the job of applications software - but they monitor and perform many operations at speed far beyond the capabilities of a human operator. Operating software comprises the operating system, the assembler, compiler or interpreter, and utility programs.

OPERATOR The person who operates the computer, looks after libraries of files and programs, and checks paper or other input/output media. In the case of microcomputers, the operator may also be the user, i.e., the person who inputs data and makes use of the microcomputer's output to do his or her job.

OPERATOR MANUAL Written instructions for the person who actually operates the computer.

OUTPUT The results of processing data. Output may be in machine-readable form, such as magnetic tapes or disks, or may be in human-readable form, such as computer print-outs or displays on the CRT.

PACKAGE A program or set of programs, available from the computer manufacturer or a software company, designed to process a particular type of application. Since software packages are "pre-programmed", they can save a tremendous amount of time, and effort in design, programming, testing and documentation. But since they are standard (i.e., designed to meet the common or usual requirements), they may not do exactly what a particular user wants. To be truly considered a package, the program must have been thoroughly tested and debugged. It should also be capable of being used without major alteration by a class of users (e.g., small municipalities), and should be properly documented. To be considered a proven package, the package should be successfully installed at two or more user sites. A base package is a standard package that can be modified more or less extensively to meet a particular user's requirements. (The package is written with the intention of being used in this way.) See also Functional Package, Generic Package.

PARALLEL CONVERSION A parallel conversion is one in which the old system is maintained while the new, computerized system is being installed and tested, to verify that the new system is producing the results it is supposed to produce.

PASCAL A high-level programming language used for business and scientific programs.

PASSWORD A secret set of characters that should be known only to authorized people. The password must be entered before access can be gained to the computer.

PCB see Card.

PERIPHERALS (OR PERIPHERAL DEVICES) A collective name for the equipment that is attached to the computer to perform input, output or storage functions, e.g., keyboards, CRTs, disk drives, printers. The peripherals are external to the CPU and main memory but are under the CPU's control to a lesser or greater degree.

PERSONAL COMPUTER In the early days of microcomputer technology, microcomputer computers had very limited power. They were expected primarily to be used by and to serve the needs of one person, hence the term 'personal computer'. Microcomputers are still used to meet the needs of one person, but so-called personal computers are now powerful enough to be used as the sole computer resource for a small organization.

PIRATE To give away or sell copies of software products without paying the producer or the licensed distributor of the product. Piracy is illegal. In contrast, programs in the public domain may generally be freely copied.

PL/1 (PROGRAMMING LANGUAGE #1) A compiled programming language developed by IBM for mainframe computers.

PLOTTER A device that draws graphs, pictures or schematics. The pen or other drawing instrument operates under the control of the computer.

PORT Ports (or interfaces) allow data to pass to and from the computer and its peripherals. Externally, the port takes the form of a sophisticated electrical plug, with several pins, which connects the peripheral's cable to the computer unit. Internally, the port's circuits recode the signals so that the receiving or sending element can understand them. The RS 232 serial port is the most common form of interface. There are also parallel ports. See Serial Transmission; Parallel Transmission.

PORTABILITY The ability of a program to be used on different makes of computer.

PRINTED CIRCUIT BOARD see Card.

PRINTER A peripheral device that converts coded data into printed form, thus functioning as a robot typist. See also Dot-matrix printer; Letter-quality printer; CPS; LPM.

PROCESSING A series of actions or operations intended to produce a result. A computer processes data in accordance with programmed instructions.

PROGRAM A set of instructions directing the computer to perform a task. The normal sequence of instructions is the following: read information; process it (add, subtract, etc.); update existing files with new information; and output (display, print or store) information. Also used as a verb meaning to compose such a set of instructions.

PROGRAMMER A person who writes a program in the code of a particular programming language. In doing so, the programmer translates input and output requests, logic flows and calculations into a set of computer instructions.

PROGRAMMING LANGUAGE A systematic code used for writing the instructions that together make up a program. BASIC, FORTRAN, COBOL and PASCAL are examples of widely used programming languages, each with its own symbols, "grammar", spelling rules, and so on. Languages come in different versions. Thus BASICA is similar, but not identical, to BASIC.

PROMPT A word or phrase that appears on the screen asking the operator to enter certain information, e.g., Enter data.

PROTOCOL A set of rules, formats and practices governing data communications between computers and terminals. Protocols determine such things as how to verify accuracy, and address messages, as well as the number and types of information and devices that can communicate.

PURGE To remove unwanted data or data files. For example, draft documents are usually purged from the computer storage medium after the final document has been approved.

RAM (RANDOM ACCESS MEMORY) The main, internal memory of the computer, into which programs and data are entered for processing during the actual execution of the program(s).

RANDOM ACCESS (or DIRECT ACCESS) A method of accessing that allows the computer to go directly to a stored data record without having to read an entire disk or tape. Compare with Sequential Access.

RANDOM ACCESS MEMORY see RAM.

READ A computer "reads" data by sensing the magnetized dots on a disk or diskette, or the electrical pulses on a communication line.

READ-WRITE HEAD Part of the disk drive that reads and writes on the concentric tracks of a disk.

RECORD A collection of related data items; a logical unit of information concerning a unique entity, e.g., all the information pertaining to one taxpayer's account - name, address, balances outstanding, etc. Each record usually has a unique identifier, or key, by which the system can identify it, e.g., the taxpayer's account number. See also Data Base.

RECOVERY The re-starting of a system after it has been out of action as a result of a malfunction or an error condition.

RESPONSE TIME The interval between entering data into a computer and receiving a response.

RFP (REQUEST FOR PROPOSAL) A formal document requesting vendors to submit proposed solutions to an organization's (computer) requirements. May also be called an RFQ (Request for Quotation).

ROM (READ ONLY MEMORY) An internal memory holding permanent instructions for the computer, not changeable by the user.

RPG (REPORT PROGRAM GENERATOR) A high-level programming language used for business applications, particularly to format and print the results of data-processing programs.

RS232 or RS232C A standard specified by the Electronics Industry Association for the physical connections between computers and other devices (e.g. modems or printers) for the serial transmission of data. The standard specifies the number of pins on the connector and types of control circuits and electrical signals that will pass through the connection. See also Port; Serial Transmission.

RUN The series of activities that the computer carries out to complete a processing task (e.g., the tax billing run).

SAVE A command that tells the computer to store data or a program that is to be used again.

SCREEN The television-like screen of a CRT.

SCROLL To move data or the cursor up or down on a screen.

SECURITY Refers to protecting the computer hardware, software and documentation from theft, misuse or physical damage, as well as safeguarding the information that is stored and processed by the computer. Information must be protected against unauthorized access, modification or destruction.

SEQUENTIAL ACCESS A method of accessing that obliges the computer to read all the stored data in sequence, until it reaches the required data record. Records are also placed into storage in the computer in a specific sequential order.

SERIAL TRANSMISSION The transmission of one bit of data at a time over a line. Serial input/output is usually performed in accordance with RS-232C. Contrast with Parallel Transmission.

SERVICE BUREAU A service bureau is a facility that provides processing, programming, or other services to people beyond the organization that owns the facility. Thus it includes organizations that are solely in the computing business, commercial enterprises that charge outsiders for the use of excess capacity, or government agencies that permit others to use programs and/or computers.

SMALL BUSINESS COMPUTER A microcomputer or a minicomputer capable of performing as a small organization's central computer.

SOFTWARE A generic name for computer programs and their supporting documentation. See also Applications Software and Operating Software.

SORT To arrange records in a particular sequence, e.g., by date due, by amount owed, etc.

SPOOLING (SIMULTANEOUS PERIPHERAL OPERATION ON LINE) A technique whereby output data to be printed is temporarily saved on disk. The operator instructs the printer to start printing once the processing has been completed, and can carry on with other tasks using the microprocessor while the output is being run off on the printer. Spooling allows two or more users to request the use of the printer simultaneously without having to wait for each print program to execute completely in turn.

STANDALONE Refers to a computer (or some other type of equipment such as a word processor) that functions independently as a self-sufficient unit. A standalone microcomputer is thus not linked to any other computer or to any network.

STOCK TAB Continuous-feed paper for everyday use on a printer. The paper has no letterhead or special columns, etc.

STORAGE Storage is the physical means of storing data and programs, either in the main computer or on auxiliary devices. Storage media include paper tapes, and magnetic tapes and disks.

STREAMER TAPE A magnetic tape used for backing up a hard disk. The technique of streaming speeds up the transfer of data by eliminating gaps between blocks of data that occur with other recording methods. A streamer tape is a faster and more reliable means of backing up a hard disk than ordinary audit cassette tapes.

SYSTEM A system in general means a group of related activities. Here it is usually used as a short form for "computer system". Depending on context, it refers to the combination of hardware that constitutes a particular configuration, or an application that uses the computer as part of the overall system, or the hardware and software together.

SYSTEMS ANALYSIS The analysis of an activity or series of activities to determine exactly what must be accomplished and how to accomplish it.

TAPE see Magnetic Tape.

TELECOMMUNICATION The transmission of data between computer devices over long distances, usually via telephone lines.

TEMPLATE Two types of templates are available with some application packages. A keyboard template, made of cardboard or plastic, can be fitted over the keyboard. The template shows which keys do what when the application is being run on the computer. The second type of template may be part of a computer program or it may be available on a separate diskette or as a book. It sets out the steps to be followed when using interactive programs such as spreadsheets or data bases, in order to achieve a particular result, e.g., you can produce an annual budget using a budget template for a spreadsheet package.

TERMINAL A generic name for any piece of equipment that enables people to communicate with a computer, either directly or from a remote location. Thus terminals are input/output devices. 'Terminal' refers to the CRT and the keyboard considered together; however, a terminal could also consist of a keyboard and a printer. A microcomputer may have a single terminal (one CRT and one keyboard) or two or more terminals, i.e., it may be a multi-terminal microcomputer. With only one terminal, the microcomputer can obviously be used by only one person at a time. A microcomputer could be linked to a mainframe, in which case the microcomputer's terminal serves both as a terminal to the mainframe and as a terminal to the microcomputer itself.

THROUGHPUT The amount of information that a computer can process in a given time. One way of measuring a computer's capacity (e.g., this computer throughput is 200 cheques per hour).

TURNKEY Refers to a system installed by a vendor for which the purchaser has only to "turn the key"; a system that theoretically, at least, requires no further modifications or programming by the user.

TUTORIAL DISKETTE A diskette that the user can sometimes obtain from a hardware or software vendor which explains how to use the equipment or the program. It is intended for self-study.

UPDATE The addition to, deletion of, or changes to data that bring the data or program up to date. (Used as a noun or a verb.)

UPGRADE To enhance or expand a computer installation. In contrast with a conversion, the existing facility itself is not altered. Instead, a disk drive or other components may be added. Upgrading software means adding new features to the software. As a noun 'upgrade' refers to the enhancement itself.

USER FRIENDLY Used to describe hardware or software that people who are not data processing professionals will supposedly find easy to learn. 'User friendly' software, for example, might include menus of options, prompts, help features and so on. The commands are self-explanatory, e.g., Save.

USER MANUAL A documented description of a system or application together with instructions so that users can work with it. User manuals should describe all the non-computer

activities as well as how to use the equipment, handle the input/output devices and run the programs. They should also contain samples of forms.

USERS The people who make use of the computer system to carry out functions for which they are responsible. In the case of a microcomputer, the user may also be the operator.

UTILITY PROGRAM Frequently used, special-purpose programs usually supplied by the system vendor. Utility programs edit data, diagnose problems, manipulate files, etc.

VENDOR (Computer) The salesperson, or organization he or she represents, who sells computer hardware or software or both.

WINDOW A segment of the CRT screen used to display information independently of the display on the rest of the screen. (The effect is analogous to TV programs where a split screen shows the viewer two or more separate pictures at the same time.) The isolated segment of the screen is considered to be a "window" into the computer's memory.

WORD Used in connection with computers, a 'word' refers to the "clump" or "package" of data that the CPU handles as a single logical unit. A word has a fixed number of bits. Early microprocessors handled 8 bits of data at a time. A microcomputer with this word size thus has an 8-bit processor. The newer machines have 16- or 32-bit microprocessors. Since they "think about" and move data around in larger chunks, they are usually faster and more powerful than 8-bit microprocessors.

WORD PROCESSING The computerized entry, processing and output of text. The text can be readily re-arranged and corrected. Word processing can be done on a computer using a word processing package, or on a dedicated word processor. The latter equipment, unlike a general-purpose computer, is specifically designed to process text (i.e., it has special features on the keyboard, screen and in the software).

WRITE The computer or an output device writes a record by magnetizing dots in a coded pattern. It works in much the same way as a tape recorder. Writing is the process by which information is copied from RAM onto a storage device (disk, diskette or tape) or output device (display screen or printer).

SOURCES OF INFORMATION, AND BIBLIOGRAPHY

INFORMATION AND ADVICE

Depending on what point you have reached on the road to installing a computer, you are likely to turn to different sources for information advice. Your chief sources during the feasibility, requirements, definition, and selection phases are likely to be other municipalities that have installed computers, this Publication and other publications about computers, the staff of the department's advisory services and municipal finance branches. You may also have obtained information and advice from your municipal auditor, council, educational institutions, businesses or individuals in your community.

The software vendor should provide information, advice and training for both software and hardware.

You may well want to learn something about computers before commencing a study for your municipality. You or staff members may feel the need for additional training after the computerization project has begun.

The following may offer you some important sources of information:

1. Associations

There are also several municipal associations that offer services (mostly publications) to their members. They are the International City Management Association (ICMA), the Municipal Finance Officers Association of the U.S. and Canada (MFOA), the Urban and Regional Information Systems Association (URISA), and the International Institute of Municipal Clerks (IIMC).

The International City Management Association is presently developing microcomputer programs designed specifically for municipal government. The following new products were announced in March 1984:

Available: . Records Management System
 . Minute Minder System
 . Microfilm Retrieval System
 . Financial Trends Monitoring System

Under Development: . Public Works Work Order System
 . Police Dispatch Support System

2. Vendors

Vendors can supply you with information and literature about their products. Hardware vendors should be able to advise you about generic and other software packages that will run on their equipment, and the accessories available.

3. Computer Magazines

A good way of keeping up with developments in computers and the ways they are used is to read popular computer magazines. These magazines generally do not set out to teach you the basics, but they do explain new concepts as they come along. They also give you a feel for the marketplace through review of both hardware and software products and through advertisements.

Be aware that U.S. magazines quote U.S. prices. The same products are likely to cost much more in Canada. As a rule of thumb, you can take the U.S. dollar price, and add 50% to it to estimate the Canadian dollar equivalent.

Some Canadian magazines that deal with computers and microcomputers in a business or administrative setting are ComputerData, InfoAge, and Computing Canada. American magazines include Byte, Interface Age, Desktop

Computing, Infoworld, and PC: The Independent Guidelines to IBM Personal Computers. These titles are only a sample - there are many more.

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TRADE MARKS AND REGISTERED NAMES

The names of the following products referred to in this publication are trade marks and registered names.

<u>PRODUCT NAME</u>	<u>TRADE MARK OWNER</u>
CP/M, CP/M-80, CP/M-86, Concurrent CP/M	Digital Research Inc.
Info Globe	Division of the Globe and Mail
Lotus 1-2-3	Lotus Development Corporation
MS-DOS	Microsoft Inc.
PC-DOS	IBM
UNIX	Bell Laboratories Inc.
VisiCalc	VisiCorp
WordStar	MicroPro International Inc.
Xenix	Human Computing Resources Corp.